MultiLoad II User Guide

Including:

MultiLoad II

MultiLoad II SMP

MultiLoad II Mobile

Part # 6017

Firmware Version 3/4.31.11

June 2013

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CHAPTER 1 BEFORE YOU BEGIN

1.1 WHO SHOULD USE THIS GUIDE

This guide is intended for those individuals at your terminal who will set up and use the MultiLoad II system: terminal managers, system administrators, terminal operators, technicians, and meter proving personnel,

1.2 HOW THIS GUIDE IS ORGANIZED

The *MultiLoad II User Guide* is organized by functional procedures. It mirrors the MultiLoad II menu structure. Each chapter discusses a single procedure or a group of related procedures that are necessary to set up and use the system. The following table provides an information map to the material in this guide.

Chapter	Audience	Topics Covered
1. Before You Begin	All	Conventions Used in This Guide.
2. System Description	All	System description, Remote and Local operating modes, System components, Navigation, Data Entry, and Getting Started.
3. GUI Configuration Tool	System Admin, Facility expert	Purpose, Access, Menu Functions, Navigation, and Local Control only parameter configuration.
4. General Configuration	System Admin, Facility expert	Communication Setup, Equipment Setup, Product Setup, Presets, Additive Calibration, Access IDs, System Date and Time.
5. Product Flow Control	System Admin, Facility expert	Flow control configuration for single product delivery and calibration.
6. Additive Control	Additive expert	Configuring for different additive control methods: piston only, pulser input, etc.
7. Diagnostics	System Admin, Technician, Electrician	Loopback Test; Diagnostics for Bay, Preset, Meter, Component and Additives
8. Weights & Measures	System Admin, Technician	Meter pulse resolution, Meter Factors/Calibration, Temperature Calibration
9. Views and Inquiry	Operators	View presets, totalizers and meter temperatures.
10. Operation	Drivers, Operators	Phases of Operation, Keypad Entry, Local Control Operation, Remote Control Operation, TMS Authorization, SMP Ditto.
11. Custom Logic	Admin, analyst, programmer	How to customize activation of outputs using Boolean logic statements.

1.3 DOCUMENTATION CONVENTIONS

The following documentation conventions are used throughout this guide.

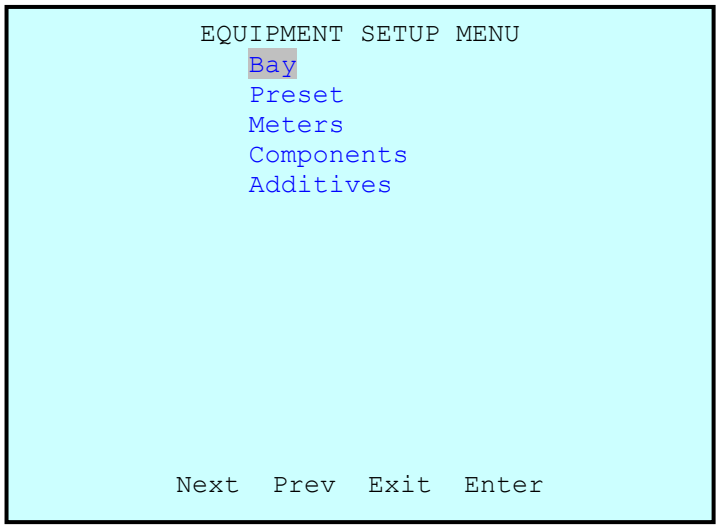
1.3.1 SCREEN SAMPLES

The field data shown are provided as *samples only*.

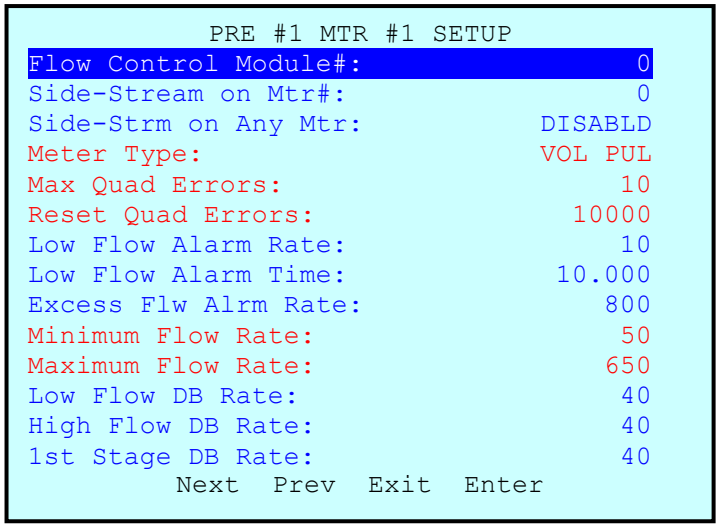
1.3.2 PROCEDURES

Procedures that should be followed in order are shown in a step-by-step format. Usually, the result of a user action is shown on the next line. For example:

1. From the Configuration Menu, choose **Equipment Setup.** Press **Enter**. The Equipment Setup Menu appears.



2. Press **Next** until Meters is highlighted. Press **Enter**. The Meter Setup screen displays:


PRE #1 MTR #1 SETUP
Flow Control Module#: 0
Side-Stream on Mtr#: 0
Side-Strm on Any Mtr: DISABLD
Meter Type: VOL PUL
Max Quad Errors: 10
Reset Quad Errors: 10000
Low Flow Alarm Rate: 10
Low Flow Alarm Time: 10.000
Excess Flw Alrm Rate: 800
Minimum Flow Rate: 50
Maximum Flow Rate: 650
Low Flow DB Rate: 40
High Flow DB Rate: 40
1st Stage DB Rate: 40
Next Prev Exit Enter

1.4 INFORMATION ALERTS

The Guide uses the following graphical conventions to alert the reader to different kinds of information:

	Notes provide additional, supplementary, or "nice-to-know" information not actually necessary to the current task or topic.
	Cautions alert you to the possibility of unexpected results when performing an action. They are also used to inform you of important things to keep in mind.
	Warnings inform you of the possibility that damage might occur as a result of performing a certain action or *not* performing a certain action. Pay close attention when you see the warning symbol!

1.5 TYPOGRAPHICAL CONVENTIONS

The following typographical conventions are used throughout the Guide.

Boldface	Indicates what you are asked to key in or which button(s) to press on the MultiLoad II keypad. Example: "Key in **00000** and press **Next**."
Italic	In topic text, italic indicates a key MultiLoad II term or industry term. Example: "The display features a *pick list* style of item selection." Italic is also used for emphasis.

CHAPTER 2 SYSTEM DESCRIPTION

2.1 OVERVIEW

This chapter introduces you to the MultiLoad II system by defining its capabilities, describing its operating modes, identifying its main components, and discussing navigation of the user interface.

Main topics covered are:

- System Overview
- Two Operating Modes
- System Components
- Navigating The System
- Switch Access Control
- Getting Started
- The MultiLoad II Configuration Tool (MultiMate)

2.2 SYSTEM OVERVIEW

The MultiLoad II is designed to manage multiple loading arms delivering straight or blended products. The system can operate in conjunction with the Toptech TMS system (remote processing mode) or in Local (stand alone) mode. The MultiLoad II supports:

- 12 loading arms
- 5 meters per loading arm, 6 component ratio blending.
- 8 components per loading arm, 8 component sequential blending.
- Sequential, Ratio and Side-stream blending.(proportional as non-proportional blending)
- 16 additive injectors per loading arm
- Digital, two stage, and Analog 4-20mA control valves
- RTD temperature inputs
- 4-20 ma input for either density, relative density, api gravity, pressure or bsw
- Ethernet communications
- Ethernet printing

MultiLoad II Single Meter Preset (SMP) is an economical package, designed to support single load arm/single meter applications. The system can operate in conjunction with the Toptech TMS system (remote processing mode) or in Local (stand alone) Mode. The MultiLoad II SMP supports:

- 1 loading arm
- 1 meter
- 8 components (different meter factors for each product)
- No blending.
- 2 additive injectors
- Digital, two stage, and Analog 4-20mA control valves
- RTD temperature input
- 4-20 ma input for either density, relative density,api gravity, pressure or bsw
- Ethernet communications
- Ethernet printing

2.3 TWO OPERATING MODES

The MultiLoad II can be configured to operate in three different modes:

Local (stand-alone) Control Mode – product and access information are stored in non-volatile memory in the MultiLoad II.

Remote Control Mode – access and product information is controlled by TMS or another remote computer system.

UAP – Interfacing with a host-system in the cloud which has all basic TAS functionality

2.3.1 LOCAL CONTROL MODE

In local mode, the MultiLoad II RCU will read a driver's Prox Card (Excluding the SMP) or will prompt the driver to enter an access ID. Next the driver will be prompted to enter a PIN code. The supplied driver card or access ID and PIN must match a record in the driver database stored in the non-volatile memory of the MultiLoad II RCU. Once verified, the MultiLoad II will act upon its internal configuration regarding additional prompts. The MultiLoad II has up to 5 configurable prompts that may be presented to the driver. Once these data entry prompts have been recorded, loading will be authorized.

Capabilities of the MultiLoad II operating in Local mode are:

- 300 access ID's and associated PIN codes.
- 10,000 transaction archives complete with salable product, component detail and additive detail.
- 5 user-configurable custom prompts; resultant data stored with each transaction.
- 33 product recipes per meter/loading arm.
- Meter Ticket – combined ticket for all transaction liftings in user-configurable format.
- Meter, Additive, and Temperature Calibration features.
- Log of the last 1000 Weights and Measures parameter changes.

2.3.2 REMOTE CONTROL MODE

When interfaced to a remote computer system, the number of driver records, customer prompts and recipes is virtually unlimited.

2.3.3 UAP MODE

This is an interface to the cloud and has all basic functionality of a TAS-system in the cloud.

2.4 SYSTEM COMPONENTS

The Toptech MultiLoad II family of products is available in the following configurations.

- MultiLoad II – Multiple Arm, Multiple Component Blending System.
- MultiLoad II SMP (Single Meter Preset) – 1 Arm, Single Component Blending System

Field equipment is connected to the system via an internal I/O board, several external FCM (Flow Control Modules), or a combination.

2.5 MULTILOAD II RCU

The Remote Control Unit (RCU) of the MultiLoad II System is the driver interface to the system, performs all high level process control, contains all configuration information, totalizers, and event logs. The driver interface contains a keypad, display and prox card reader (excluding the SMP).

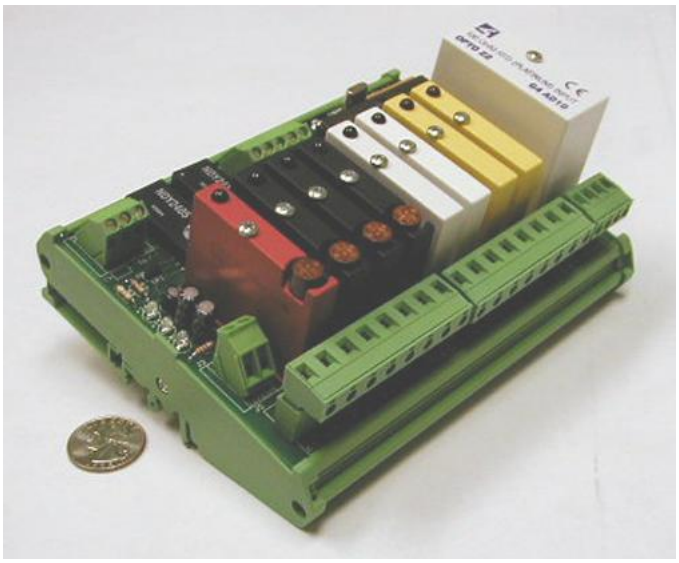
2.5.1 RCU ENCLOSURES AVAILABLE WITH MULTILOAD II.

- Division 2 Enclosure (with optional internal I/O Board)
- Division 1/Zone 1 Explosion Proof Light (EXL) Enclosure (with optional internal I/O Board)

2.5.2 RCU ENCLOSURES AVAILABLE WITH MULTILOAD II SMP

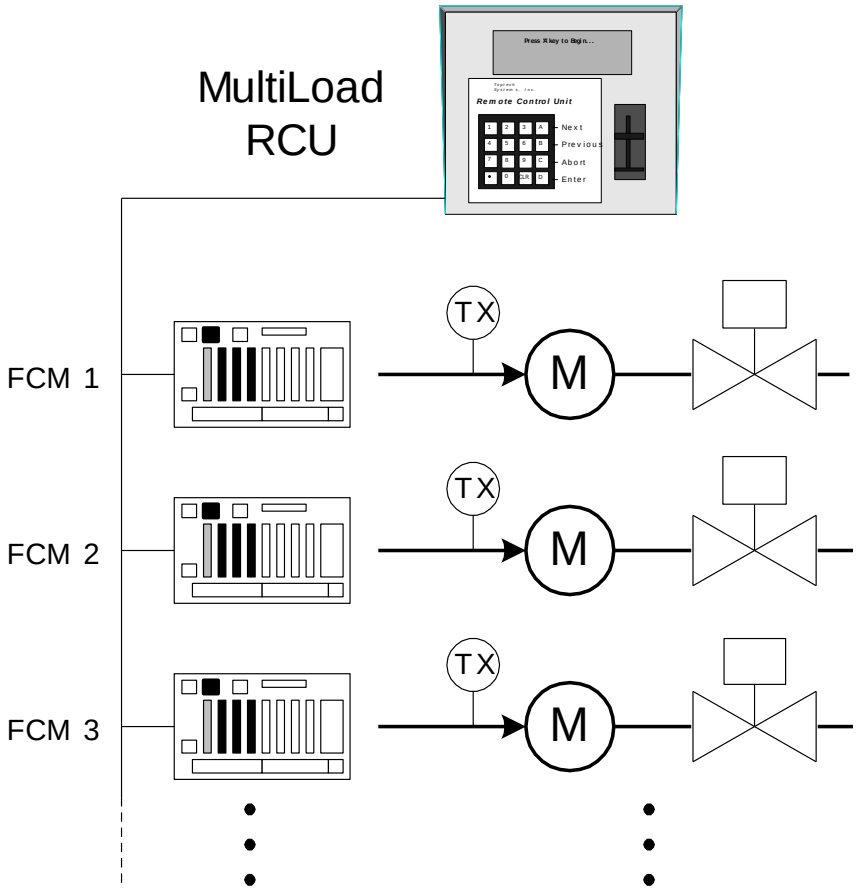
- Division 1/Zone 1 SMP Explosion Proof Enclosure with internal I/O Board (no Card Reader)

2.6 EXTERNAL FCM (FLOW CONTROL MODULE)



The MultiLoad Flow Control Module (FCM) is a state-of-the-art device that delivers the maximum in flexible, modular flow control processing. The FCM contains its own microprocessor for digital valve control, meter pulse counts and factoring, additive injection, pump and meter permissives, and more. As a major component of the MultiLoad, the FCM functions as “the preset on a card.” Its highly modular design allows you to satisfy your current flow control needs and to expand easily and inexpensively as your needs grow. Whether it’s single product loading, ratio blending, or sequential blending, the MultiLoad can handle all your flow control requirements - now and into the future.

The primary purpose of the FCM is to provide maximum control of a single meter run. Each FCM controls up to one meter run. FCM’s can be ganged together to form multiple component ratio or sequential blend spots or for single product delivery on multiple arms.



2.7 FCM II

The Flow Control Module (FCM) is an integral part of the MultiLoad system. The FCM contains its own microprocessor for digital/analog valve control, meter pulse counts and factoring, additive injection, pump and meter permissives, DC & AC General purpose I/O, RTD Input, 4-20 mA input/output and more.

The utilization of FCMs enables you to extend control beyond the confines of the expensive, heavy metal boxes that clutter today's load racks. Now you can buy as much or as little as you need, and locate that control where it is needed. This design lowers equipment and installation costs significantly compared to traditional presets.

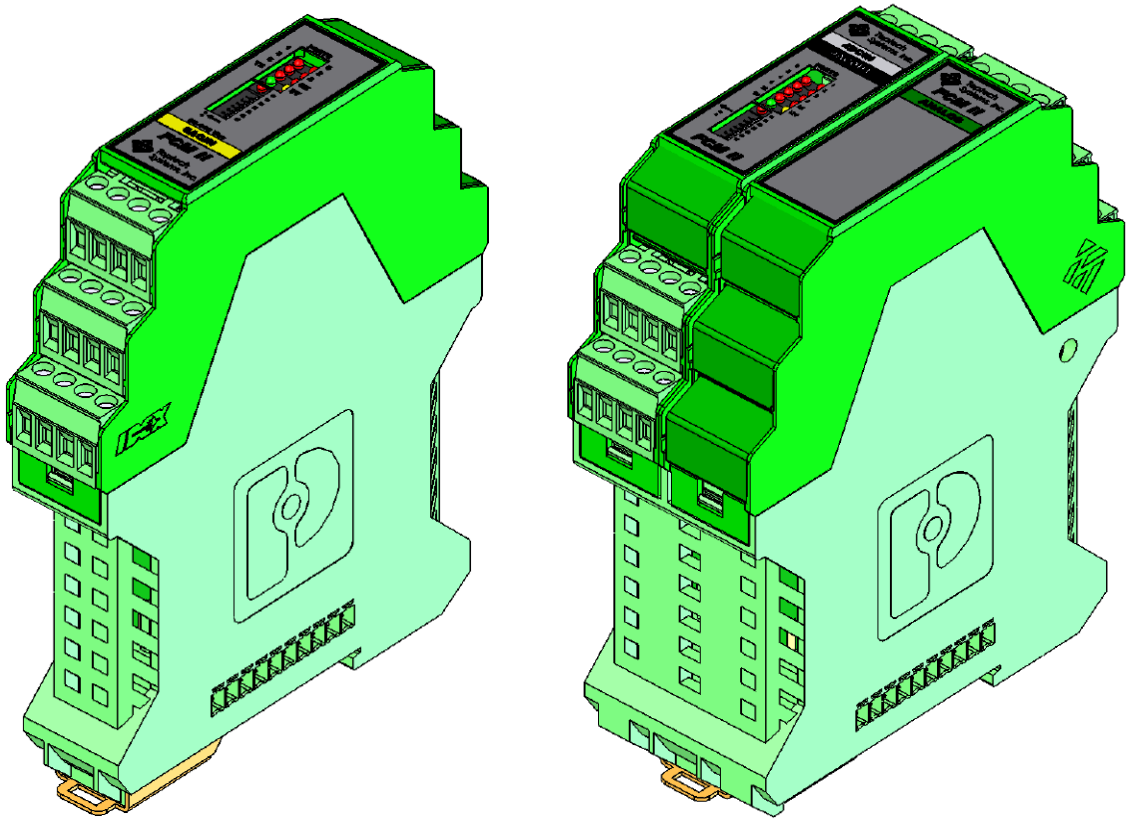
If you need to add a preset to the loading lane, you don't have to purchase, wire and install an entire traditional preset device. All you have to do is snap one or more Flow Control Modules into the FCM enclosure and configure accordingly.

In addition to providing all of the original functionality found in the previous generation units, FCM II introduces a variety of new features in a compact new package.

Modular Construction - FCM II is available in eight varieties (featured below). This modular construction simplifies the process of FCM mapping to field devices by appropriating each FCM II model with just the right amount of I/O for its designated purpose. In addition, FCM IIs mount on DIN rail and require no wiring between units; 24Vdc and serial communications are bussed. This substantially simplifies installation and wiring.

Compact Packaging - Every FCM II occupies considerably less space than the previous generation FCM. This smaller footprint ranges from 1/3 – 1/6 the size of the original unit. This allows for more I/O per enclosure size and provides an opportunity to mount several FCM IIs in a compact, explosion-proof enclosure.

Compatibility - FCM I and FCM II utilize the same protocol and can co-exist on the same RS-485 bus. Furthermore, FCM IIs are backward compatible with previous generation FCMs allowing them to be used to replace older FCM units. In addition, FCM II is designed to work identically with all MultiLoad products.



FCM II consists of 8 different module types:

4DCIN/4ACOUT: 4 DC Inputs (5-30 VDC), 4 AC Outputs (85-250 VAC)
6ACIN: 6 AC Input (90-140 VAC) or (180-250 VAC)
6ACOUT: 6 AC Outputs (85-250VAC)
6DCIN: 6 DC Inputs (5-30 VDC)
6DCOUT: 6 DC Outputs (0-30 VDC)
ANALOG/4DCIN/4ACOUT: RTD Input, 4-20mA Input, 4-20mA Out, 4 DC Inputs (5-30 VDC), 4 AC Outputs (85-250 VAC)

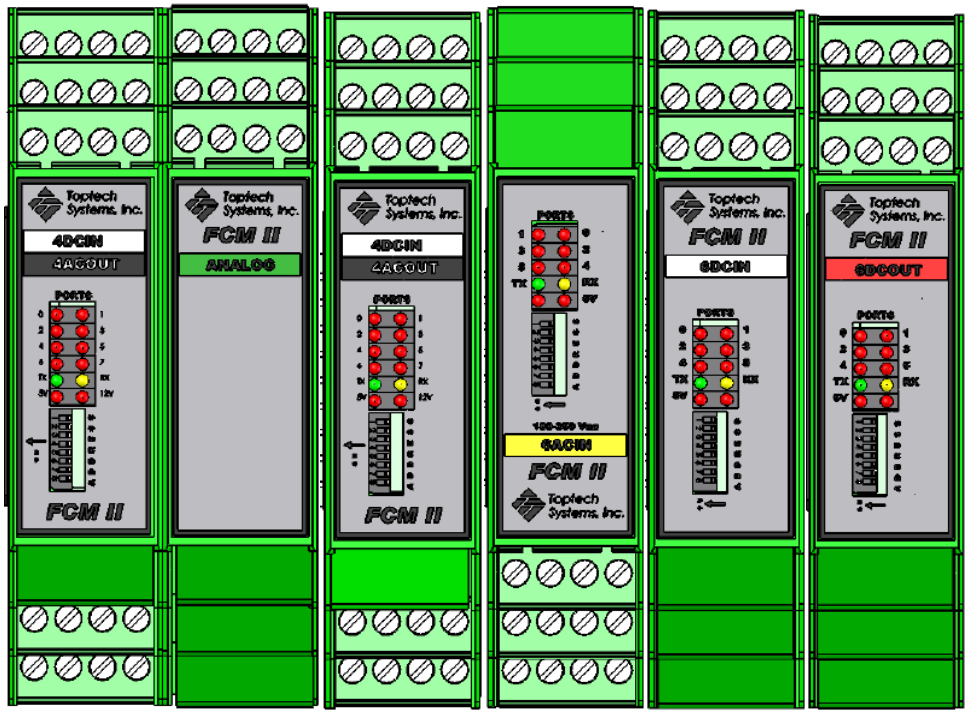
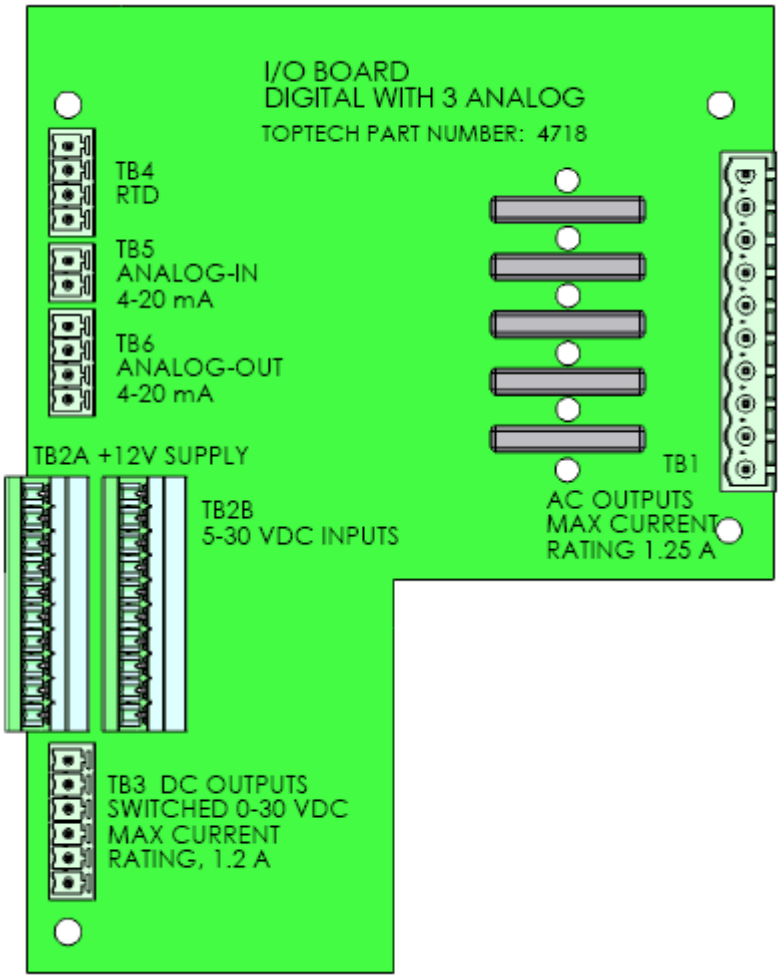


Figure 2.1 FCM II Modules

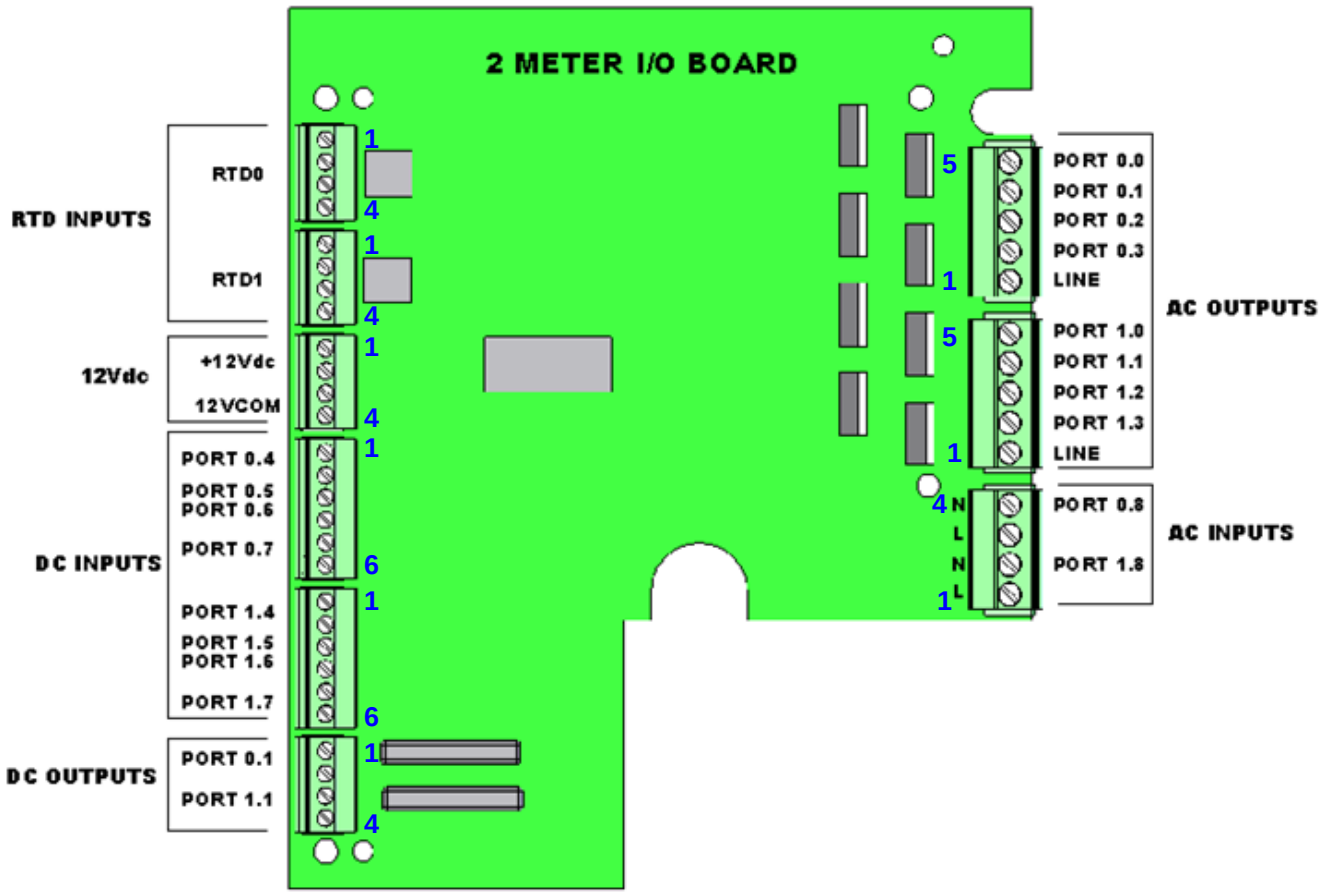
2.8 INTERNAL I/O BOARD

All RCU enclosures can support the installation of one Internal I/O board. The basic functionality of the I/O board mirrors the functions of an external FCM but adding a 4-20mA input, 4-20mA output, and several additional descrete input and outputs. An I/O board can provide control of one meter run.



2.9 INTERNAL 2-METER I/O BOARD

All RCU enclosures, excluding the Division 1/Zone 1 SMP Explosion Proof Enclosure, can support the installation of one Internal 2-Meter I/O board. The basic functionality of the 2-Meter I/O board mirrors the functions of two external FCMs but adding several additional input and outputs on that of an FCM. An 2-meter I/O board can provide control of up to two meter runs.



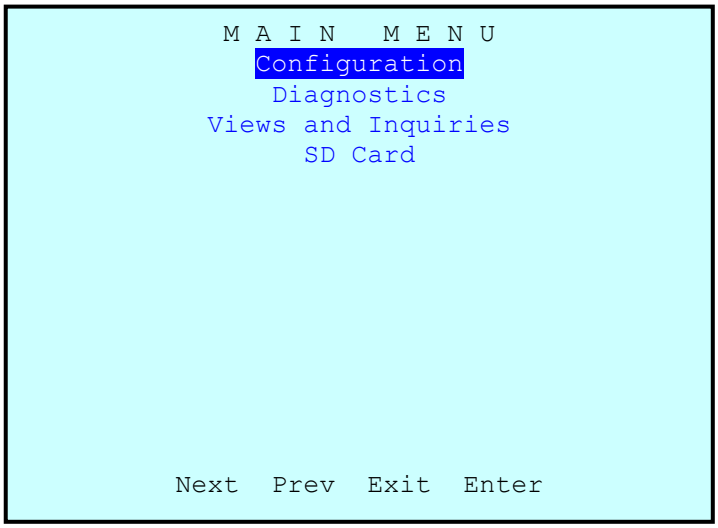
2.10 NAVIGATING THE SYSTEM:

The following describes how to navigate the system, select field values, perform data entry, and toggle options on and off.

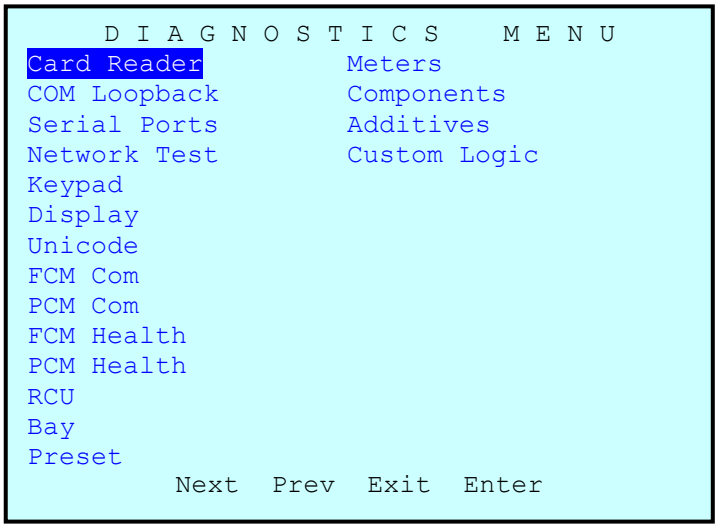
Note: All unknown or not allowed sequences of switch or key actuations are rejected and have no impact on the software or measurement data.

2.10.1 MENUS AND SCREENS

The MultiLoad II Main Menu is shown below. From this menu, you select one of four main functions.



The reverse video highlight bar indicates the current selection. Press **Next** to select Diagnostics, and then press the **Enter** key to go to the Diagnostics Menu.



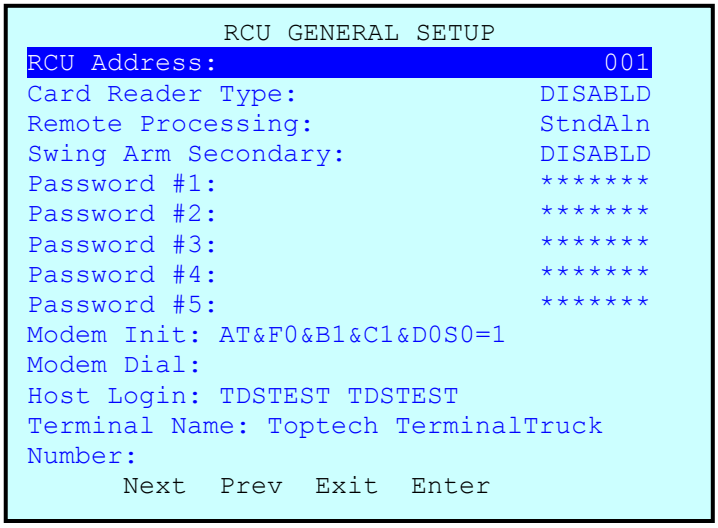
For menu options and function screen items, pressing the **Next** key moves the selection bar down, and pressing the **Prev** (Previous) key moves the selection bar up.

To return to the Main Menu, press **EXIT**. To return to any previous screen, press the **EXIT** key.

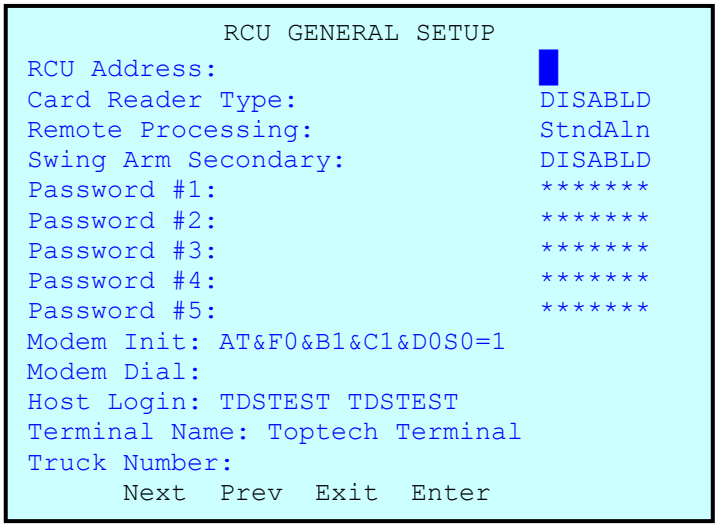
Note:Depending on the card-reader mode the Card Reader Screen could be appear as iButton Reader .

2.10.2 FIELD MODIFICATION AND DATA ENTRY

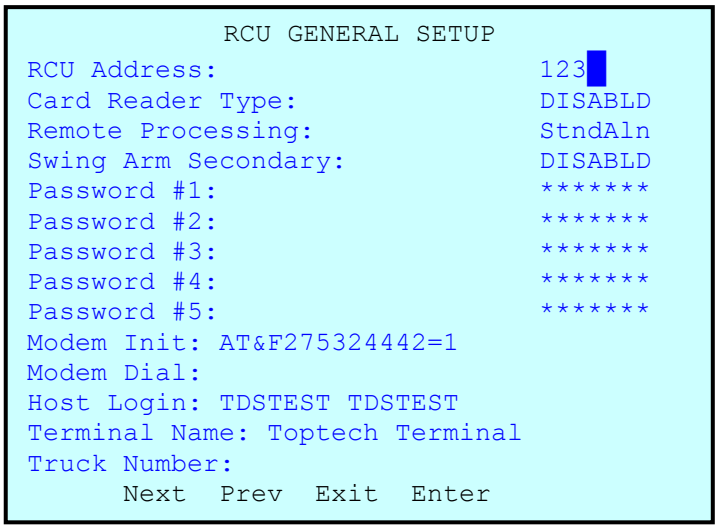
MultiLoad II will have all fields populated with default values. There are two types of fields, toggle or data entry. Toggle fields contain a number of choices. Scroll through the choices by pressing the **Enter** key. Data entry fields require that a value be entered into the field, within a given, applicable range. In the example below, RCU Address field is highlighted.



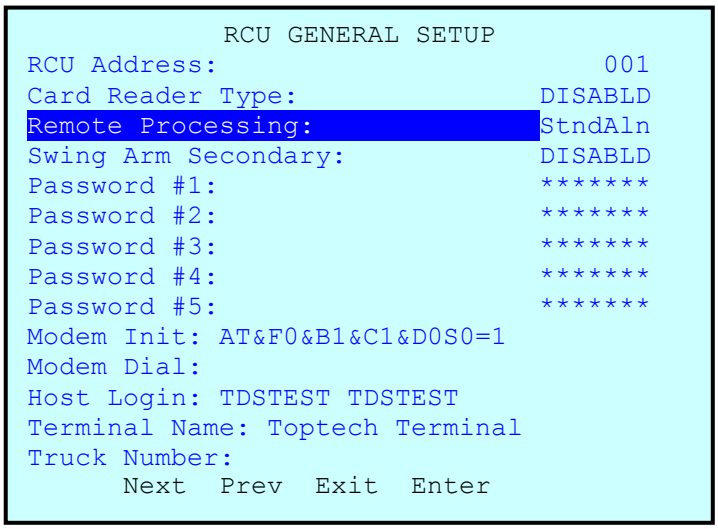
Press **ENTER** to choose the field. A blinking cursor indicates data can be entered.



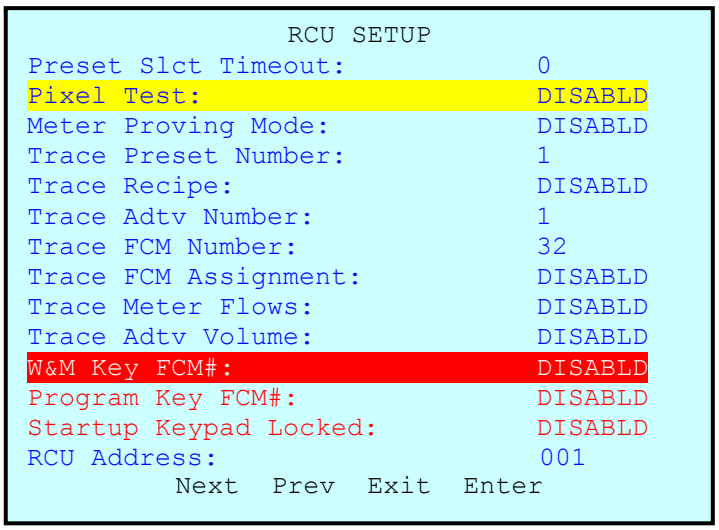
Type in the new value (e.g. 123) and press **ENTER**. The new value displays on the screen.



Using this same screen as an example, the Remote Processing line is selected and **ENTER** is pressed, use the **NEXT** or **PREV** keys to toggle between the values ENABLED and DISABLD, as shown below. You must then press **ENTER** to accept the desired choice.



Parameters that are displayed in RED are Weight and Measures controlled values. The W&M switch must be active before modification can take place. All changes made to Weights and Measures controlled values will be logged in the W&M Change Log.



In the RCU, Bay, Preset, Component, Meter and Additives setup screens, parameters that are highlighted in YELLOW indicate values that have been modified from the factory default value.

2.11 SWITCH ACCESS CONTROL

MultiLoad II supports external access control switches. This switches limit access to Program Mode and changes to Weights and Measures controlled parameters (Values displayed in red).

There are three types of external switches and all can be sealed and/or locked to prevent access to Program Mode and prevent changes to Weights and Measures controlled parameters.

In Program Mode the operator has access to the following:

- The Configuration Menu parameters
- The Diagnostics Menu and its functions
- Other administrative procedures, such as clearing high-level alarms.

To access Program Mode, the MultiLoad II terminal operator must:

1. Move the Program Mode switch into the active position.
2. At the idle card in screen, enter the security code (default security code is 000000) and press the <Next> key.

Your local Weights and Measures office may need to be contacted after breaking the seal and changing parameters. This is typically done only during meter proving or temperature calibration.

2.11.1 TYPE 1 PROGRAM / W&M SWITCHES

Type 1 switches consist of two separate external rotary switches, one for Program Mode Access, and one for W&M change access. Each switch has external fold down cover that can be locked or sealed with a wire and lead seal to prevent moving the switch into the active state. Each cover will also be stamped as “W&M” or “Program” to indicate function.

Figure 2.2 Type 1 Program / W&M Switches

2.11.2 TYPE 2 PROGRAM / W&M SWITCHES

- Type 2 switches consist of a single 3-position external rotary switches, where each position corresponds to an operating mode. The switch has two external fold down covers that limits the switch rotation as described below. Each cover can be locked or sealed with a wire and lead seal to prevent moving the switch into the active states. Each cover will also be stamped as “W&M” or “Program” to indicate function.

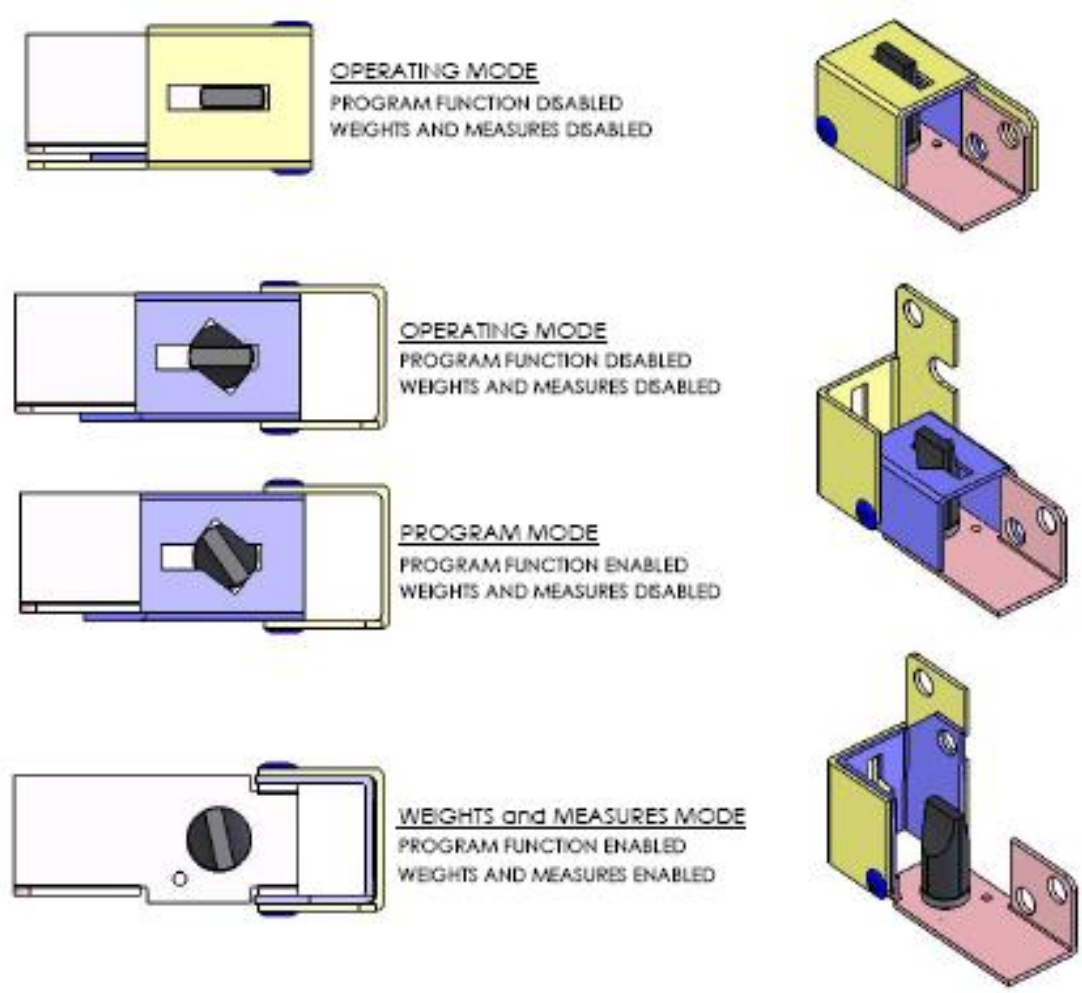


Figure 2.3 Type 2 Program / W&M Switches

2.11.3 TYPE 3 PROGRAM / W&M SWITCHES

Type 3 switches consist of two separate external magnetic bolts, one for Program Mode Access, and one for W&M change access. Program or W&M access is achieved by removing the corresponding bolt. Each bolt has a small hole that can be sealed with a wire and lead seal to detect unauthorized access. Both bolts are also have an external fold down cover that can be locked to prevent moving someone from removing either bolt. The cover will also be stamped as “W&M” or “Program” to indicate the function of each bolt.

Figure 2.4 Type 3 Program / W&M Switches

2.11.4 PROGRAM MODE / W&M DIP SWITCH

Two DIP switches on the CPU board can also provide the closure of the Program Mode / W&M switch contacts. When the MultiLoad II does not have the external Program Mode / W&M switch installed, it is necessary to use this DIP switches on the CPU board to enable program mode and W&M access.

Switches are numbered 1 through 4 with 1 being closest to the front of the enclosure (top of the picture), and 4 being toward the back of the enclosure (bottom of the picture).

When switch is in the ON position, the switch is in the active state. A switch is ON when it moved right, and OFF when moved to the left.

Switch #3 is the program mode switch. Switch #4 is the W&M access switch. In the Figure below, the Program Mode switch is currently Active, while the W&M Switch is not active.

A switch input will be considered active with either the DIP switch OR external switch is active (ON).

Your Weights and Measures inspector may wish to verify that DIP switch 4 (bottom switch) is in the off position (moved left) prior to sealing the MultiLoad II enclosure to ensure that W&M parameters are secure.

Figure 2.5 CPU Board Rev 1.0 Program and W&M DIP Switches

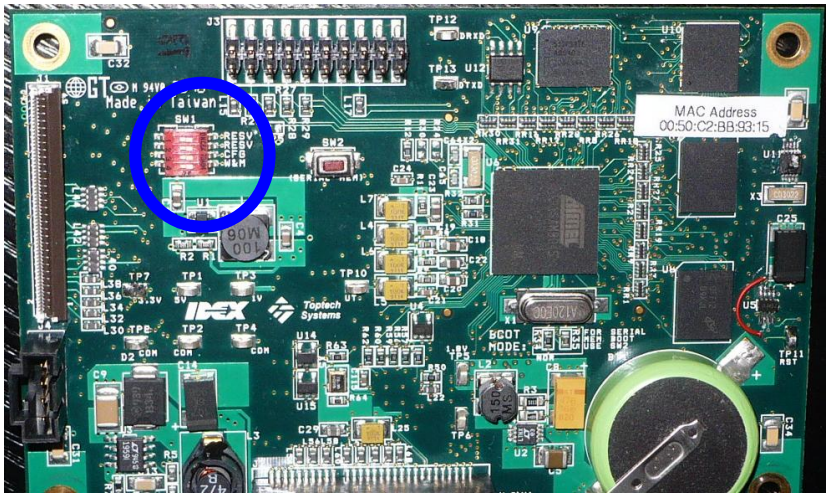


Figure 2.6 CPU Board Rev 2.0 Program and W&M DIP Switches

2.11.5 PROGRAM MODE / W&M FIELD SWITCHES

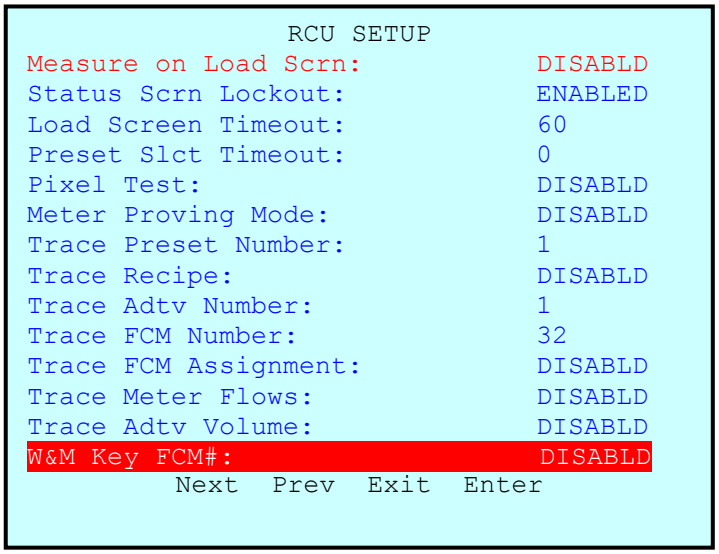
The MultiLoad II also has the ability to accept field inputs for the Program Mode and W&M Access switches.

The “W&M Key FCM#” and “Program Key FCM#” in the RCU W&M Parameters list allow any field I/O position to be the source of the switch input. See Weights and Measures for more information.

- If an external switch is wired to the MultiLoad II as a W&M access switch, the installer may be required to seal the switch enclosure and all conduit junction points between the switch and the MultiLoad II to ensure that the W&M parameters remain secure. Consult your local Weights and Measures for specifics.
- A switch input will be considered active with either the external switch OR a configured I/O point is active (ON).

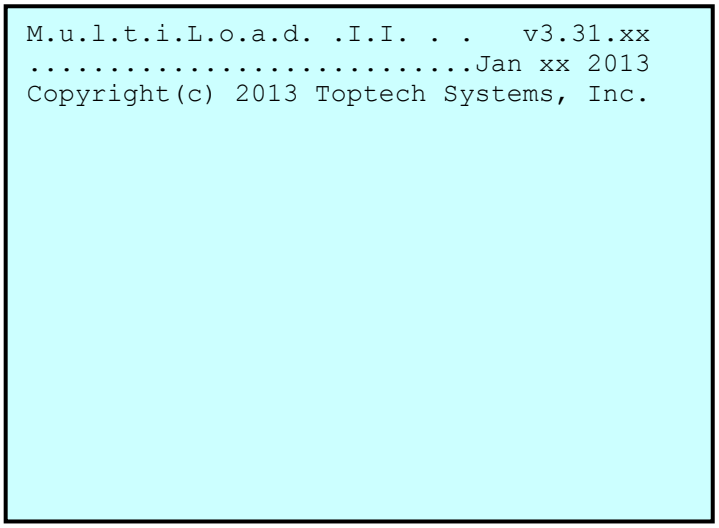
  Your Weights and Measures inspector may wish to verify the “W&M Key FCM#” parameter prior to sealing the MultiLoad II’s W&M switch to ensure that W&M parameters are secure.
  - If no external field W&M switch is installed, this parameter MUST be DISABLED.
  - If an external field W&M switch is installed, this parameter MUST indicate the correct field I/O port.

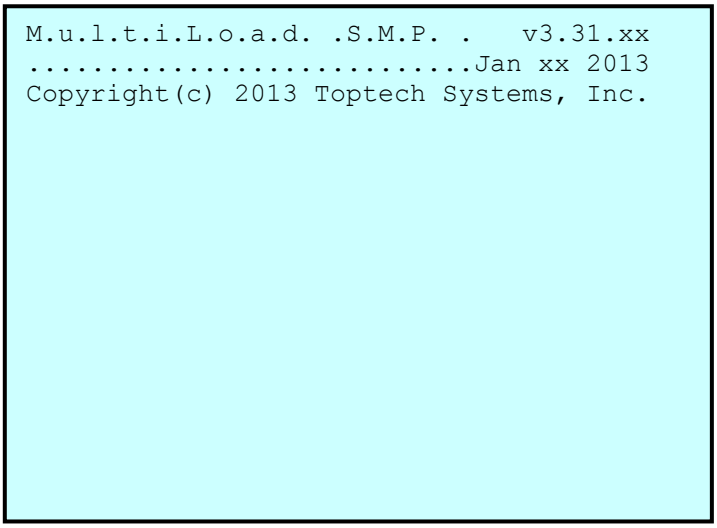
Enter Program Mode -> Configuration -> RCU Setup (page down)



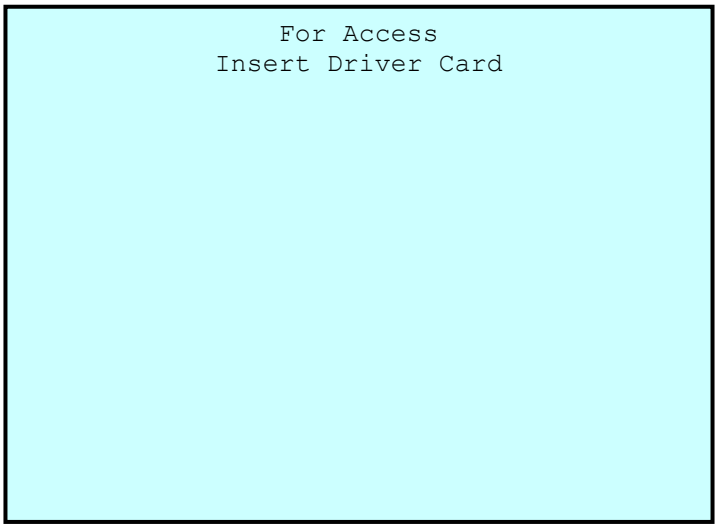
2.12 GETTING STARTED

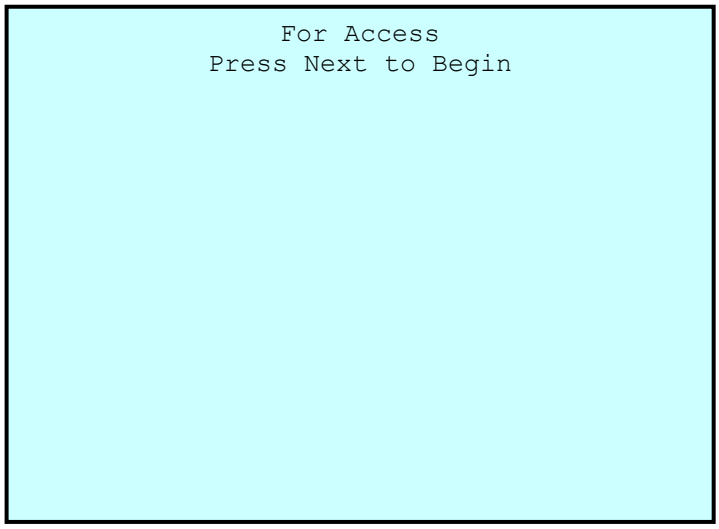
After exiting program mode, and when first powering up the MultiLoad II RCU, the Firmware identification will be displayed for several seconds.



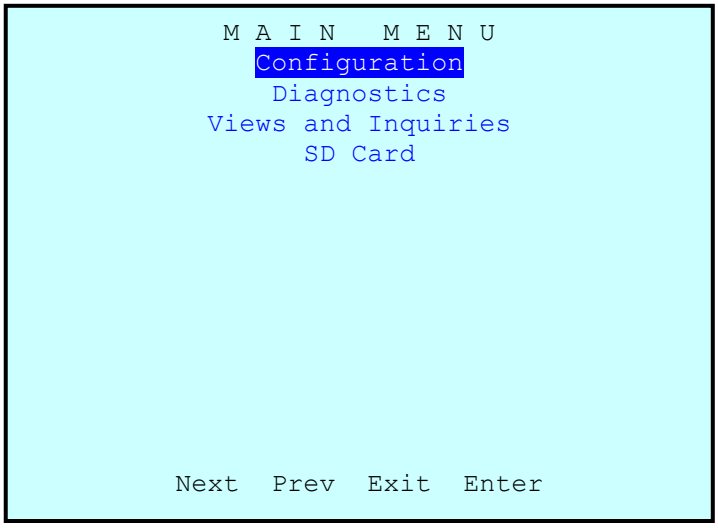


MultiLoad II will display the **access prompt** screen, indicating unit is in Operating mode.





When Program Mode Access is permissed, (see Switch Access Control), authorized personnel can enter Program Mode from this screen by keying in **00000** and pressing **NEXT**. The Main Menu displays as:



The remainder of this Guide discusses the functions available from the MultiLoad II Main Menu.

To exit the Main Menu, press EXIT. After exiting this menu, the MultiLoad II will reboot. The MultiLoad II banner screen displays briefly; showing the firmware version number.

2.13 CONFIGURATION PARAMETERS

MultiLoad II configuration screens contain configuration fields that define control parameters. The configuration parameters are stored in the MultiLoad II's non-volatile memory.

2.14 MULTILOAD II CONFIGURATION TOOL

MultiLoad II has an optional Graphical User Interface (GUI) configuration tool that allows you to configure the system from a PC. The tool enables you to create and maintain configuration files, as well as the ability to upload and download these files between the PC and the MultiLoad II. This tool also allows the uploading of new firmware images as they become available.

Detailed information on the MultiLoad II Configuration tool is covered in Chapter 3.

2.15 FACTORY DEFAULTS

If there becomes a need to reset the MultiLoad II back to the factory defaults, this can be accomplished in the following manner.

#1. Activate the W&M switch (remove the W&M bolt).

#2. Remove power from the MultiLoad II.

#3. Start pressing the "CLR" key over and over again while reconnecting power to the MultiLoad II.

#4. Stop repressing the "CLR key when "Setting Factory Defaults" is displayed.

Note: The resetting to factory defaults action will be logged in the W&M Log. Totalizers, W&M Log, and Alibi Log will NOT be cleared when resetting to factory defaults.

CHAPTER 3 GUI CONFIGURATION TOOL

3.1 OVERVIEW

The MultiLoad II GUI Configuration Tool feature is a Graphical User Interface (GUI) for configuring the MultiLoad II. Separate versions of this tool have been written for TMS 5, TMS 6 and for Microsoft Windows. This software tool can be used when the MultiLoad II is configured for Remote or Local (stand-alone) mode.

A major advantage of the Config Tool is the ability to store the configuration for a MultiLoad II unit onto a hard drive that can be backed up. In the event that the MultiLoad II configuration is lost, or the unit is damaged, the entire configuration can be restored to the replacement hardware in minutes.

Other advantages of using the GUI Config package are:

- All related parameter fields are located on one GUI screen.
- Multiple configuration files can be created and maintained.
- Most Configuration tasks can be performed at the TMS console (in Remote mode) or from a dedicated PC.
- Configuration changes can be uploaded to the MultiLoad II.
- Configuration reports can be displayed or printed.
- Screen and field Help are readily available.

3.2 ACCESS FROM TMS 5 GUI

1. From the TMS Main Menu, select:
2. Facility | Facility Configuration Menu | Load Rack Communications | TLC MultiLoad II Configuration.
3. A blank Configuration Screen displays.
4. Open the File menu on the menu bar and choose Open.
5. A File Selector dialog box displays.

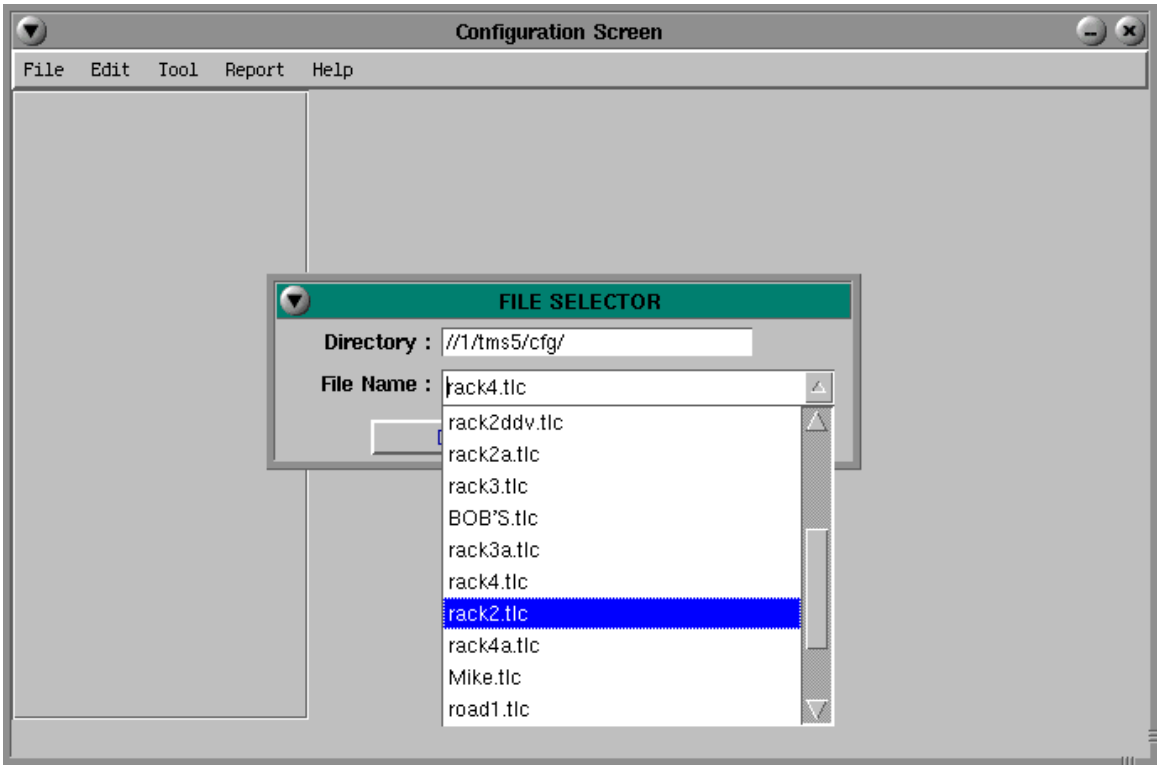


Figure 3.1 File Selection Screen

6. Click the drop-down arrow to the right of the File Name field.
7. Select the file name that appears. This file has been pre-configured at Toptech for your facility. It can be modified, and you can create new configuration files that can be downloaded to the MultiLoad II.
8. After selecting the configuration file, click the Done button.

9. The Bay Level Configuration screen displays.

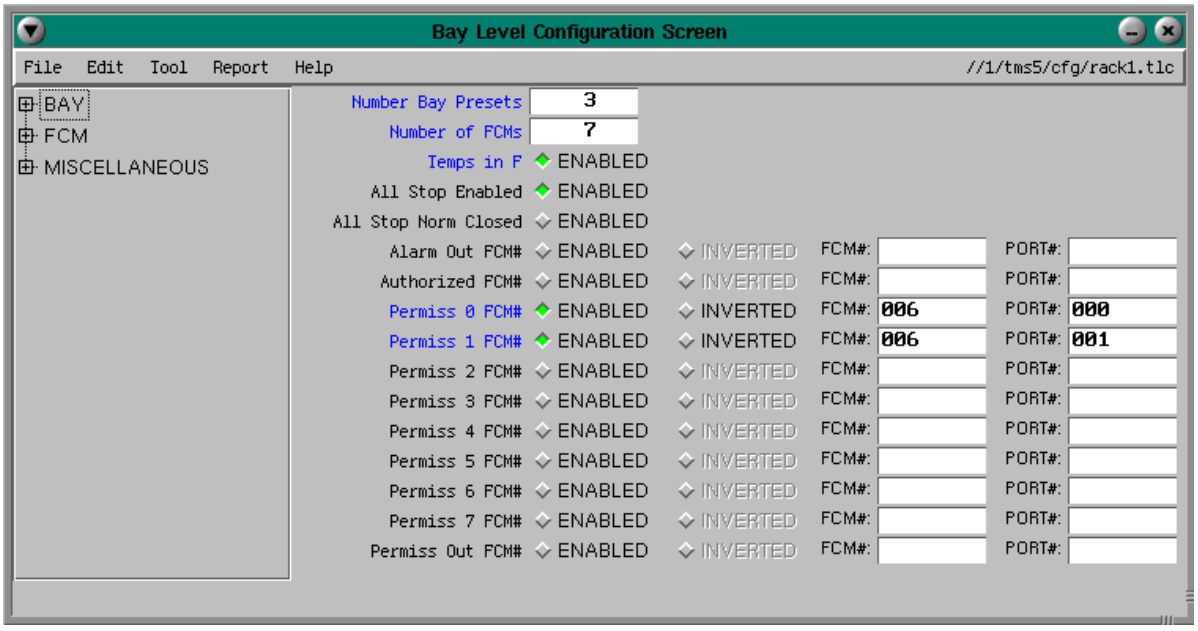


Figure 3.2 Bay Configuration Menu

Notice that the fields on this screen correspond to the parameter fields found on the Bay Setup screen (from the Equipment Setup Menu) from the MultiLoad II Configuration screen.

3.3 SCREEN NAVIGATION

If you are familiar with Windows Explorer or the TMS Help system, you will already know how to access the Config Tool screens. The dynamic screen directory is located on the left side of every screen. As shown below, the main screen hierarchy consists of Bay, FCM, and Miscellaneous. The plus sign boxes indicate that lower levels exist. To access these lower level screens, click the plus box.

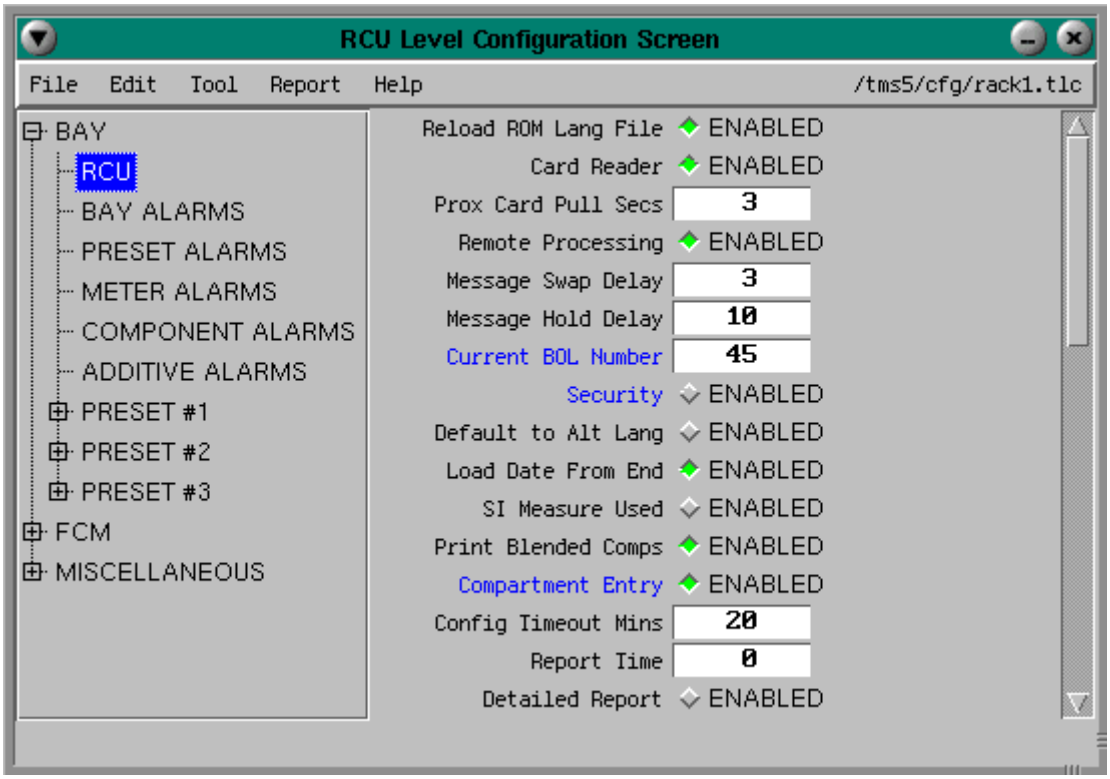


Figure 3.3 RCU Configuration Menu

For example, to access the configuration screens under Bay, click the box next to Bay. The second level of the screen hierarchy displays, and the first screen of the set is active, as shown below. The RCU Level Configuration screen becomes active and RCU is highlighted to show you where you are in the screen hierarchy.

Notice that a vertical scroll bar appears to the right of this screen, indicating more fields. You can use the scroll bar to view these additional fields, or you can simply “grab” the bottom of the screen and drag it down to elongate it. You can do the same for screens having fields to the right by either scrolling horizontally or resizing the screen.

Parameter Names in Red, are parameters that are under W&M control. Attempting to upload a value different then the value already in the MultiLoad II, with the external switch NOT in W&M mode, will cause that single parameter upload to be rejected by the MultiLoad II. After an upload a report of all rejected commands will be displayed.

Parameter Names in Blue, are parameters that have been modified from the default value. In most cases it is appropriate to leave most of the parameters at the default values. Marking parameters that have been modified from the default value is simply a way to highlight the change.

Also notice that the small box next to Bay now has a minus sign (–) in it, indicating “open.”

To “close” or “hide” the Bay screen hierarchy, click the minus sign box.

To access another screen, just click on it from the graphical hierarchy.

3.4 MENU FUNCTIONS

The following are brief descriptions of the functions available from the Config Tool main menu.

3.4.1 FILE FUNCTIONS

The following are brief descriptions of the functions available from the File menu.

New	Creates a new configuration file.
Open	Opens an existing configuration file.
Save	Saves the current open configuration file.
Save As	Saves the current open configuration file with a new name (and optionally, a new directory).
Close	Closes the current configuration file.
Exit	Exits the Config Tool function.

3.4.2 EDIT FUNCTIONS

Copy Function-permits the user to copy a preset configuration to another preset within the same bay. This feature is used for MultiLoad II products that support multiple load arms and does not apply to SMP.

3.5 TOOL FUNCTIONS

The following are brief descriptions of the functions available from the Tool menu.

3.6 BOL TICKET BUILDER

Use this function to generate a customized meter ticket based on the current configuration file.

3.6.1 DOWNLOAD REGISTERS

Use this function to download the configuration parameters (contained in the MultiLoad II registers) from the MultiLoad II to TMS.

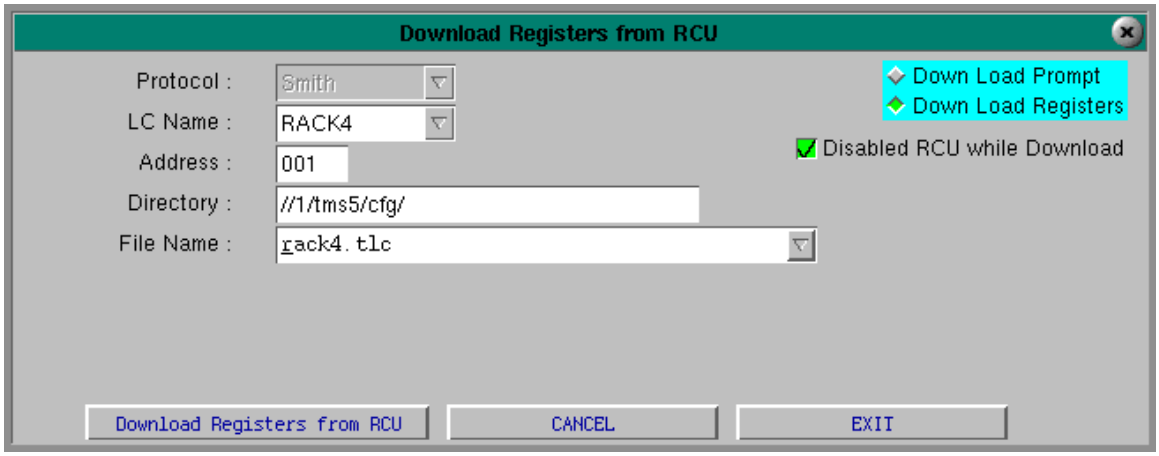


Figure 3.4 Download Window

Protocol	Type of communication protocol: Smith (default), Brooks, DanLoad.
LC Name	Line Controller that controls the serial port the MultiLoad II is on.
Address	Address of the MultiLoad II from which the configuration parameter values are downloaded.
Directory	Full directory path where the configuration file resides or will reside.
File Name	Name of the configuration file.
Down Load Prompt	The prompt file indicates information about all the configurable parameters in MultiLoad II. As firmware is updated and new parameters are added, downloading a prompt file is how to get these new parameters to display in the Configuration Tool. The language that the parameter descriptions appear in is determined by the prompt file. By setting the "ProgramMode Language" parameter to the desired language, then downloading the prompt file, all parameter description in the MultiLoad Configuration Tool will appear in the selected language.
Down Load Registers	The configuration parameter values reside in "registers" internal to the MultiLoad II. After these values are downloaded to the appropriate configuration file, the file can be edited, and uploaded into an MultiLoad II.
Disabled RCU while Download	Checking this box is recommended because it will stop the bay while the Download is in progress. Warning: If the box is unchecked (blank), it will be possible for a driver to start a load while the upload/download is in progress.

3.6.2 UPLOAD REGISTERS

Use this function to upload a configuration file to a MultiLoad II at a load rack. You would typically use this function after modifying an existing configuration file or creating a new configuration file, then uploading the file to the appropriate MultiLoad II.

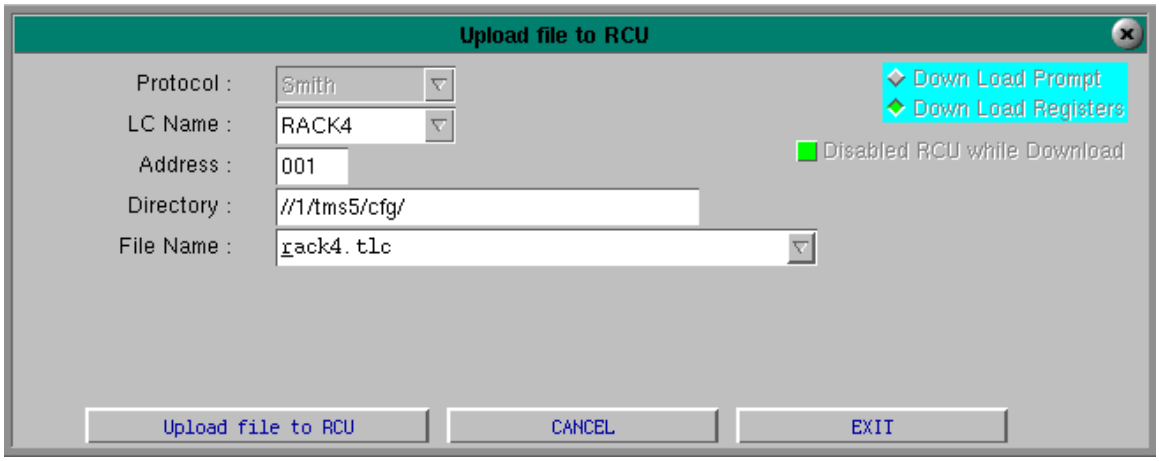


Figure 3.5 Upload Window

Protocol	Type of communication protocol: Smith (default), Brooks, DanLoad.
LC Name	Line Controller that controls the serial port the MultiLoad II is on.
Address	Address of the MultiLoad II to which the configuration parameter values are to be uploaded.
Directory	Full directory path where the configuration file resides.
File Name	Name of the configuration file.
Disabled RCU while Download	Checking this box is recommended because it will stop the bay while the Upload is in progress. Warning: If the box is unchecked (blank), it will be possible for a driver to start a load while the upload/download is in progress.

3.7 RELOAD LANGUAGE

This feature is no longer used.

3.7.1 EXTRACT AND VIEW TRANSACTION

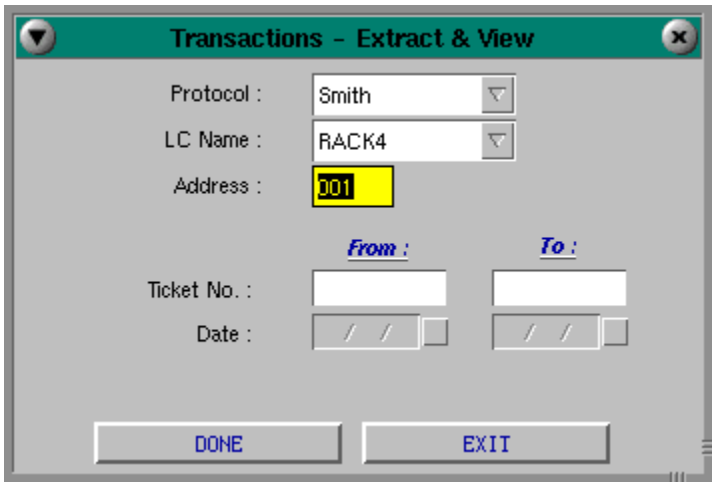


Figure 3.6 Transaction Window

3.7.2 CREATE BOLS FROM TRANSACTIONS

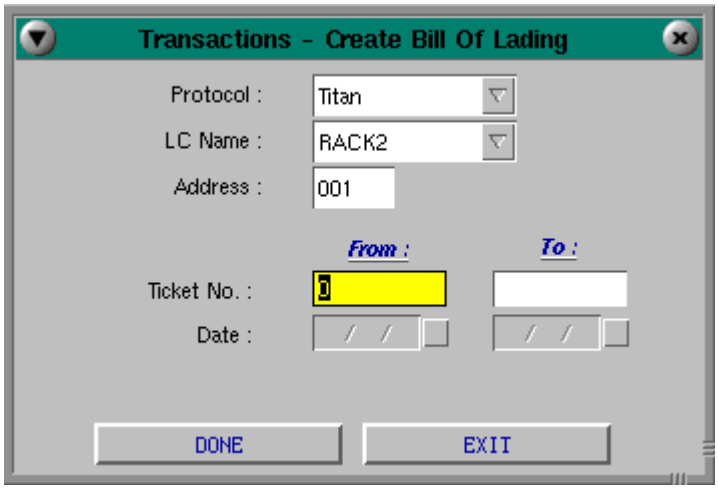


Figure 3.7 Bill of Lading (BOL) Window

3.8 MULTILOAD II REPORTS

The MultiLoad II GUI Config package provides two useful reports: the Configuration Report and the Flow Control Modules Report.

The report format, mechanism and display options are identical to those employed for TMS reports. If you need information on TMS reporting capabilities and options, please refer to the *TMS Operations Guide*.

3.8.1 CONFIGURATION REPORT

This report contains all configuration information for your MultiLoad II system.

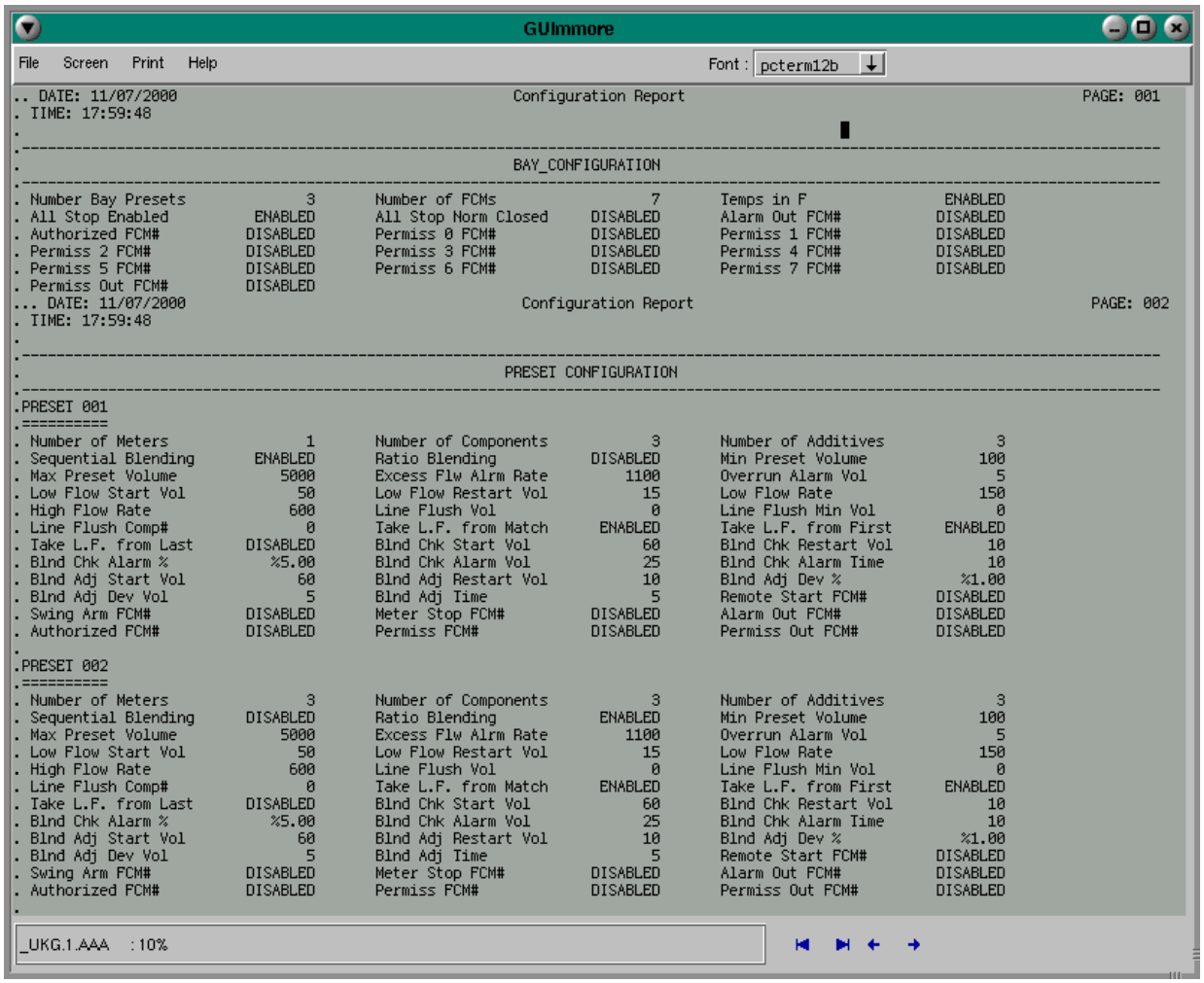

GUImmore
File Screen Print Help
Font : pcterm12b
.. DATE: 11/07/2000 Configuration Report PAGE: 001
. TIME: 17:59:48
BAY_CONFIGURATION
. Number Bay Presets 3 Number of FCMs 7 Temps in F ENABLED
. All Stop Enabled ENABLED All Stop Norm Closed DISABLED Alarm Out FCM# DISABLED
. Authorized FCM# DISABLED Permiss 0 FCM# DISABLED Permiss 1 FCM# DISABLED
. Permiss 2 FCM# DISABLED Permiss 3 FCM# DISABLED Permiss 4 FCM# DISABLED
. Permiss 5 FCM# DISABLED Permiss 6 FCM# DISABLED Permiss 7 FCM# DISABLED
. Permiss Out FCM# DISABLED
... DATE: 11/07/2000 Configuration Report PAGE: 002
. TIME: 17:59:48
PRESET CONFIGURATION
.PRESET 001
. Number of Meters 1 Number of Components 3 Number of Additives 3
. Sequential Blending ENABLED Ratio Blending DISABLED Min Preset Volume 100
. Max Preset Volume 5000 Excess Flw Alrm Rate 1100 Overrun Alarm Vol 5
. Low Flow Start Vol 50 Low Flow Restart Vol 15 Low Flow Rate 150
. High Flow Rate 600 Line Flush Vol 0 Line Flush Min Vol 0
. Line Flush Comp# 0 Take L.F. from Match ENABLED Take L.F. from First ENABLED
. Take L.F. from Last DISABLED Blnd Chk Start Vol 60 Blnd Chk Restart Vol 10
. Blnd Chk Alarm % %5.00 Blnd Chk Alarm Vol 25 Blnd Chk Alarm Time 10
. Blnd Adj Start Vol 60 Blnd Adj Restart Vol 10 Blnd Adj Dev % %1.00
. Blnd Adj Dev Vol 5 Blnd Adj Time 5 Remote Start FCM# DISABLED
. Swing Arm FCM# DISABLED Meter Stop FCM# DISABLED Alarm Out FCM# DISABLED
. Authorized FCM# DISABLED Permiss FCM# DISABLED Permiss Out FCM# DISABLED
.PRESET 002
. Number of Meters 3 Number of Components 3 Number of Additives 3
. Sequential Blending DISABLED Ratio Blending ENABLED Min Preset Volume 100
. Max Preset Volume 5000 Excess Flw Alrm Rate 1100 Overrun Alarm Vol 5
. Low Flow Start Vol 50 Low Flow Restart Vol 15 Low Flow Rate 150
. High Flow Rate 600 Line Flush Vol 0 Line Flush Min Vol 0
. Line Flush Comp# 0 Take L.F. from Match ENABLED Take L.F. from First ENABLED
. Take L.F. from Last DISABLED Blnd Chk Start Vol 60 Blnd Chk Restart Vol 10
. Blnd Chk Alarm % %5.00 Blnd Chk Alarm Vol 25 Blnd Chk Alarm Time 10
. Blnd Adj Start Vol 60 Blnd Adj Restart Vol 10 Blnd Adj Dev % %1.00
. Blnd Adj Dev Vol 5 Blnd Adj Time 5 Remote Start FCM# DISABLED
. Swing Arm FCM# DISABLED Meter Stop FCM# DISABLED Alarm Out FCM# DISABLED
. Authorized FCM# DISABLED Permiss FCM# DISABLED Permiss Out FCM# DISABLED
_UKG.1.AAA :10%

Figure 3.8 Configuration Report

3.8.2 FLOW CONTROL MODULES REPORT

The Flow Control Modules Report is a comprehensive listing of every I/O assignment on the MultiLoad II. These assignments can be on the external FCMs (excluding SMP) or on the optional internal I/O board.

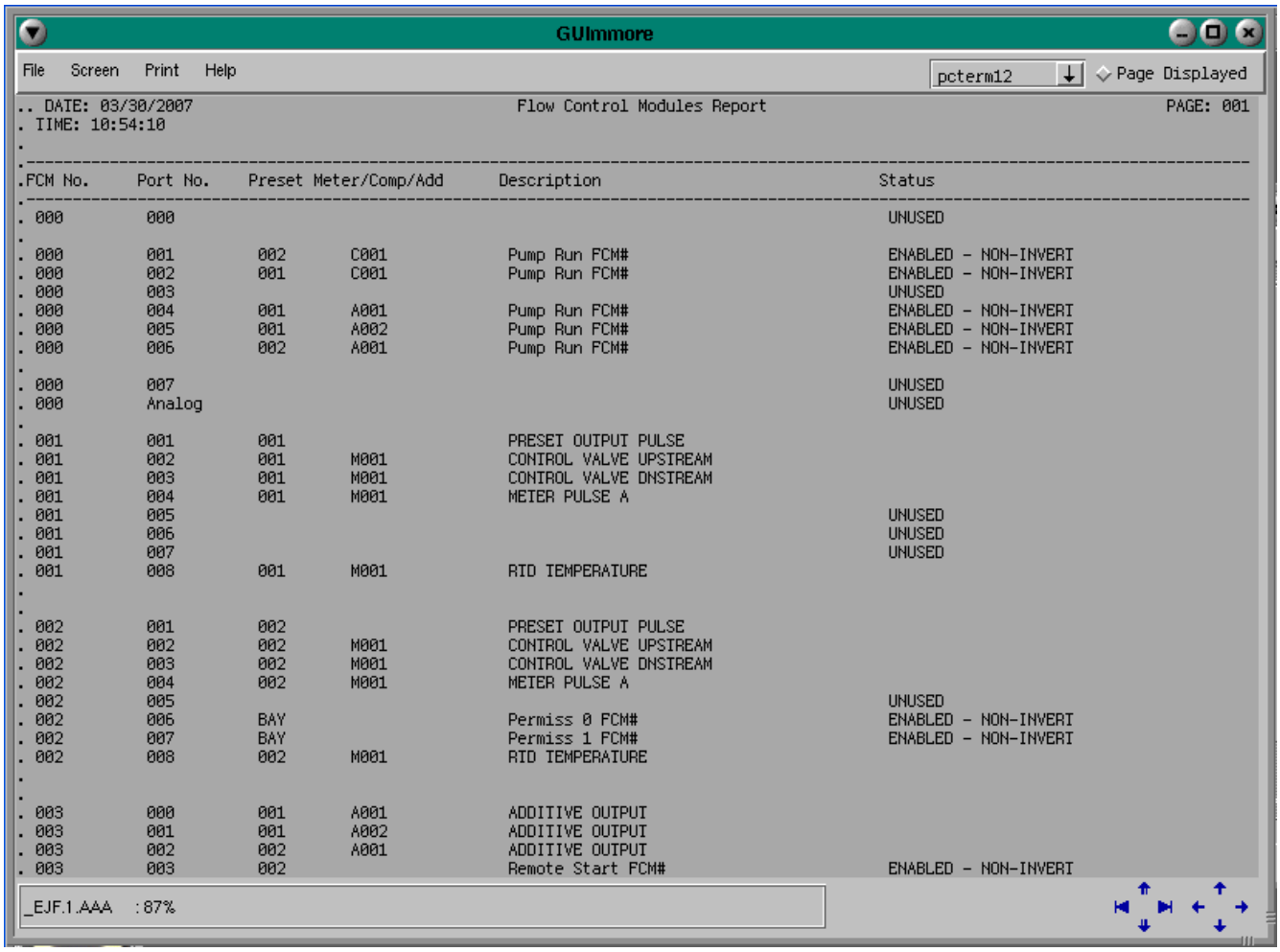

GUImmore
File Screen Print Help
pcterm12
Page Displayed
.. DAIE: 03/30/2007
. TIME: 10:54:10
Flow Control Modules Report
PAGE: 001
.FCM No. Port No. Preset Meter/Comp/Add Description Status
. 000 000 UNUSED
. 000 001 002 C001 Pump Run FCM# ENABLED - NON-INVERT
. 000 002 001 C001 Pump Run FCM# ENABLED - NON-INVERT
. 000 003 UNUSED
. 000 004 001 A001 Pump Run FCM# ENABLED - NON-INVERT
. 000 005 001 A002 Pump Run FCM# ENABLED - NON-INVERT
. 000 006 002 A001 Pump Run FCM# ENABLED - NON-INVERT
. 000 007 UNUSED
. 000 Analog UNUSED
. 001 001 001 PRESET OUTPUT PULSE
. 001 002 001 M001 CONTROL VALVE UPSTREAM
. 001 003 001 M001 CONTROL VALVE DNSTREAM
. 001 004 001 M001 METER PULSE A
. 001 005 UNUSED
. 001 006 UNUSED
. 001 007 UNUSED
. 001 008 001 M001 RTD TEMPERATURE
. 002 001 002 PRESET OUTPUT PULSE
. 002 002 002 M001 CONTROL VALVE UPSTREAM
. 002 003 002 M001 CONTROL VALVE DNSTREAM
. 002 004 002 M001 METER PULSE A
. 002 005 UNUSED
. 002 006 BAY Permiss 0 FCM# ENABLED - NON-INVERT
. 002 007 BAY Permiss 1 FCM# ENABLED - NON-INVERT
. 002 008 002 M001 RTD TEMPERATURE
. 003 000 001 A001 ADDITIVE OUTPUT
. 003 001 001 A002 ADDITIVE OUTPUT
. 003 002 002 A001 ADDITIVE OUTPUT
. 003 003 002 Remote Start FCM# ENABLED - NON-INVERT
_EJF.1.AAA :87%

Figure 3.9 I/O Assignment Report

3.9 LOCAL MODE ONLY PARAMETERS

When running in Remote mode, some MultiLoad II prompts are supplied by TMS or other TAS. When running in Local mode, these parameter values must be supplied via the MultiLoad II Configuration tool, in lieu of TMS. These “local only parameters” are accessed under the Miscellaneous group, as shown in the sample screen below.

3.9.1 DRIVER PROMPTS

When a driver attempts access, he is prompted for his PIN number. He is then prompted for the Customer who is purchasing the product and, if applicable, the particular Account of that customer. Because this data is not verified by an external computer, it must be specified locally.

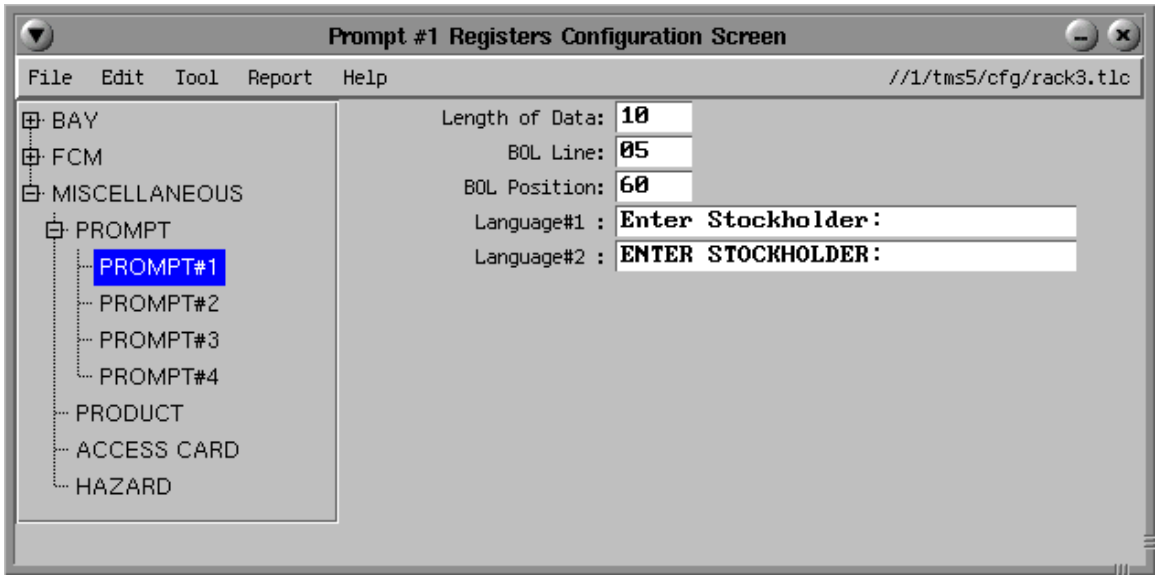


Figure 3.10 Prompt Configuration Menu

Prompt #1 will be the first prompt displayed after entry of a valid PIN. It instructs the driver to key in the product owner’s ID number. The screen below defines the prompts the driver will view, as well as the location on the meter ticket where that information will appear.

Using the sample screen above, the prompt is telling the driver to enter the Stockholder ID. Once the load completes, the value entered by the driver appear on line 10, column 68 on the subsequent meter ticket that is printed.

Length of Data	Number of characters allowed for the entry.
BOL Line	Line number on the meter ticket/Bill of Lading where the product owner’s name will appear. To disable enter **00**.
BOL Position	Column number on the meter ticket/Bill of Lading where the product owner’s name will appear. To disable enter **00**.
Language #1	The actual prompt the driver will view, in the primary language (Language A) Example: If Language A is English, **Enter Stockholder**.
Language #2	The actual prompt the driver will view, in the secondary language (Language B) Example: If Language B is Spanish, enter **Entrada Dueno De Producto**.

Prompt #2 is usually defined for the Customer.
Prompt #3 is usually defined for the Account.
Prompt #4 is usually defined for the Trailer ID.
Prompt #5 is usually defined for the Trailer2 ID.

3.9.2 PRODUCT CONFIGURATION

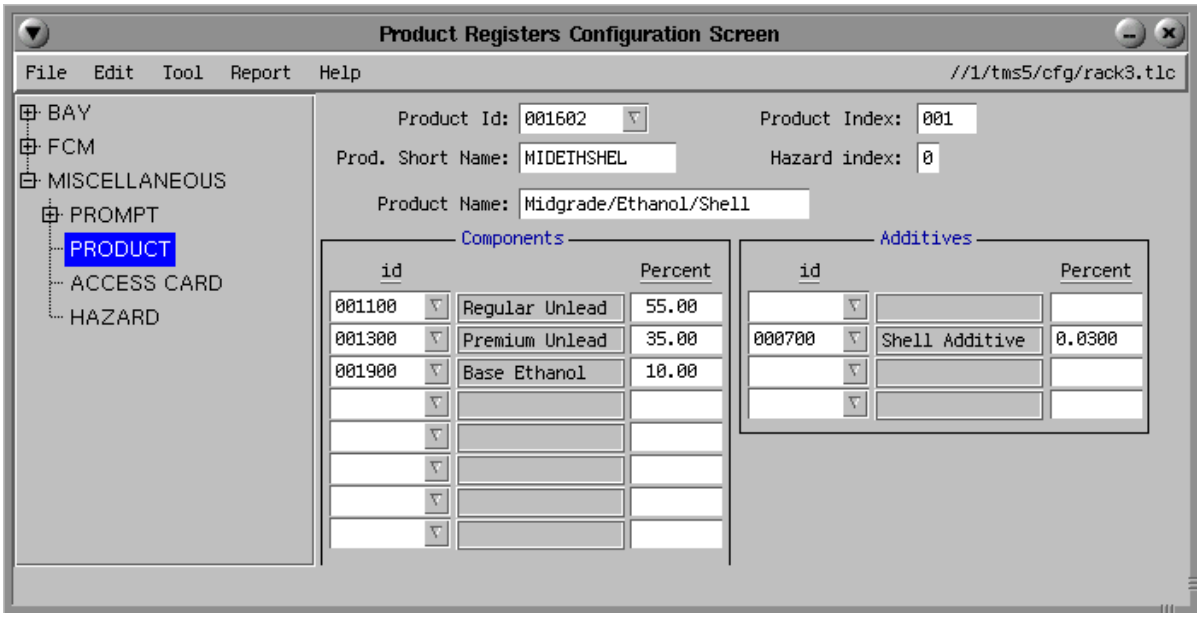


Figure 3.11 Product Configuration Screen

Under Remote control, product information is supplied to the MultiLoad II by the TMS Product database. In local mode, you must supply the product data.

Product ID	Alpha or numeric product ID; up to 5 characters.
Prod. Short Name	Short product name; up to 10 characters.
Product Name	Long product name or description; up to 25 characters.
Product Index	Index number assigned to the selected product.
Hazard Index	Up to five Hazards can be configured for stand-alone mode. Go to the Hazard menu to specify the Hazard descriptions.
Components	If the product is a blend, specify the base components and their respective percentages.
Additives	If the product includes additive(s), specify the percentage of additive that must be injected into the selected product. For example, if the amount of additive injected must be 1% of the total product, enter **1**.

3.9.3 *DRIVER ACCESS ID*

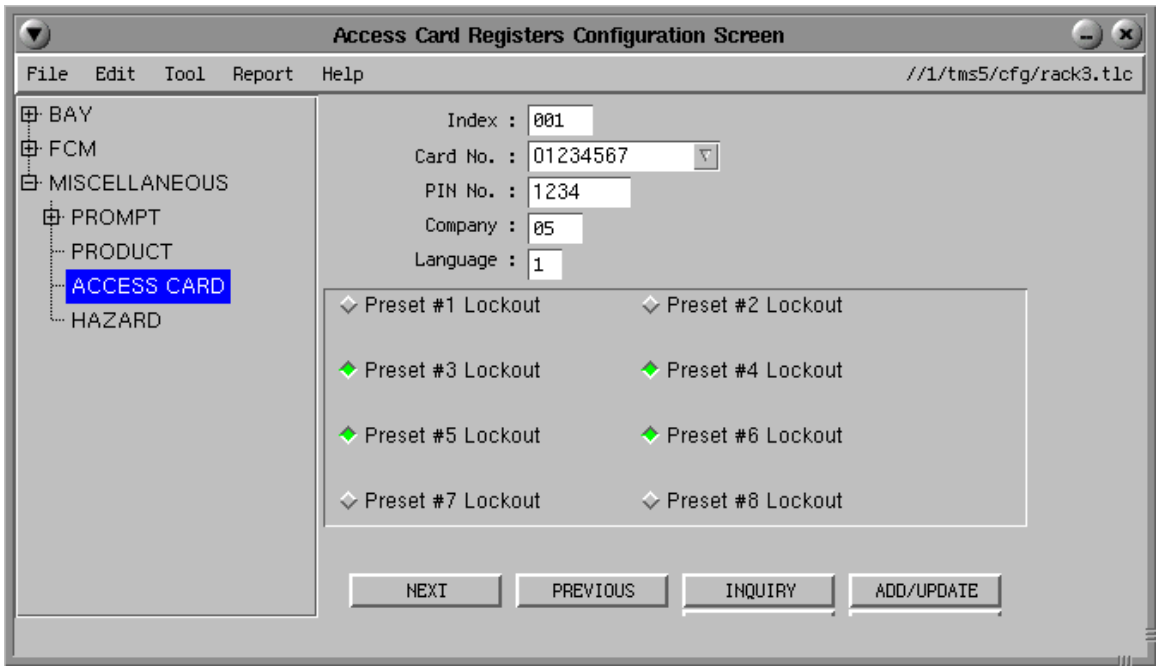


Figure 3.12 Access ID Screen

Under Remote control, driver information is supplied by the TMS Driver database. In local mode, you must supply some driver data. Do this on the Access Card Registers Configuration screen, shown here.

Index	Index number of the selected card.
Card No.	Driver ID number (8 digits).
PIN No.	Driver Personal Identification Number (4 digits).
Company	ID of the carrier for whom the driver hauls (2 digits).
Language	Language code that determines the language text that appears on the MultiLoad II display when the driver cards in or keys in.
Preset #n Lockout	When enabled (clicked on), the driver will not be allowed to load at the load arm(s) controlled by corresponding preset(s). In the sample screen above, the driver will not be allowed to load at presets 3, 4, 5 or 6.

3.9.4 HAZARD STATEMENTS

Use the Hazard Registers Configuration screen to define up to five hazard warning statements that will print on the meter ticket after loading. Each product can be assigned a hazard code via the Hazard index field on the Product Registers Configuration screen.

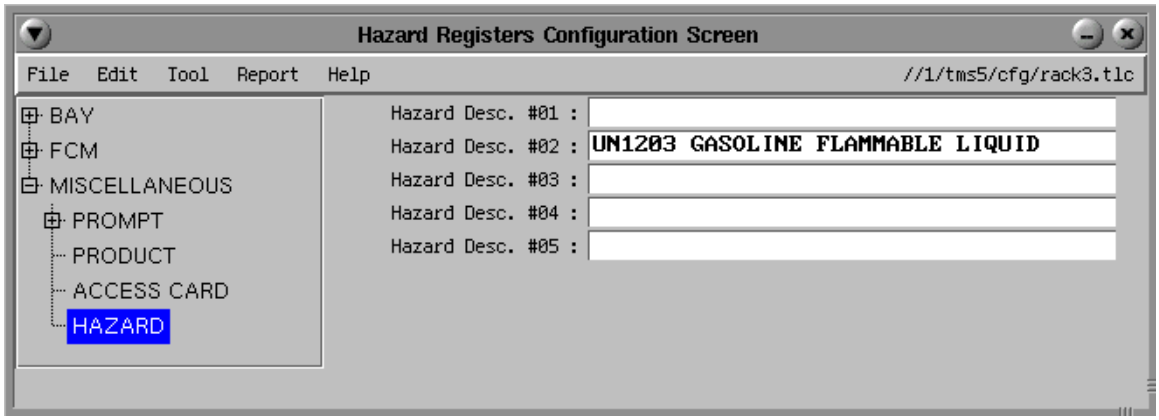


Figure 3.13 Hazard Configuration Screen

Do not use punctuation in these fields.

3.10 OTHER CONFIGURATION TOOL FUNCTIONS

All other Config Tool screens mirror the functionality available and accessible from the MultiLoad II Configuration Menu, described in the next chapter. Equivalent Config Tool screens are shown after each section describing an area of configuration: RCU Setup, Presets, Meters, Components, Additives, etc.

The one exception is the Flow Control Module Display screen, which is a convenient way to view, at a glance, how each FCM is currently configured. Each I/O port is labeled and indicates the Preset (Pn), Meter (Mn), Component (Cn) or Additive (An), as shown in the sample screens on the next page.

Clicking on an I/O port will display detail information for that port.

3.10.1 FCM GUI DISPLAY

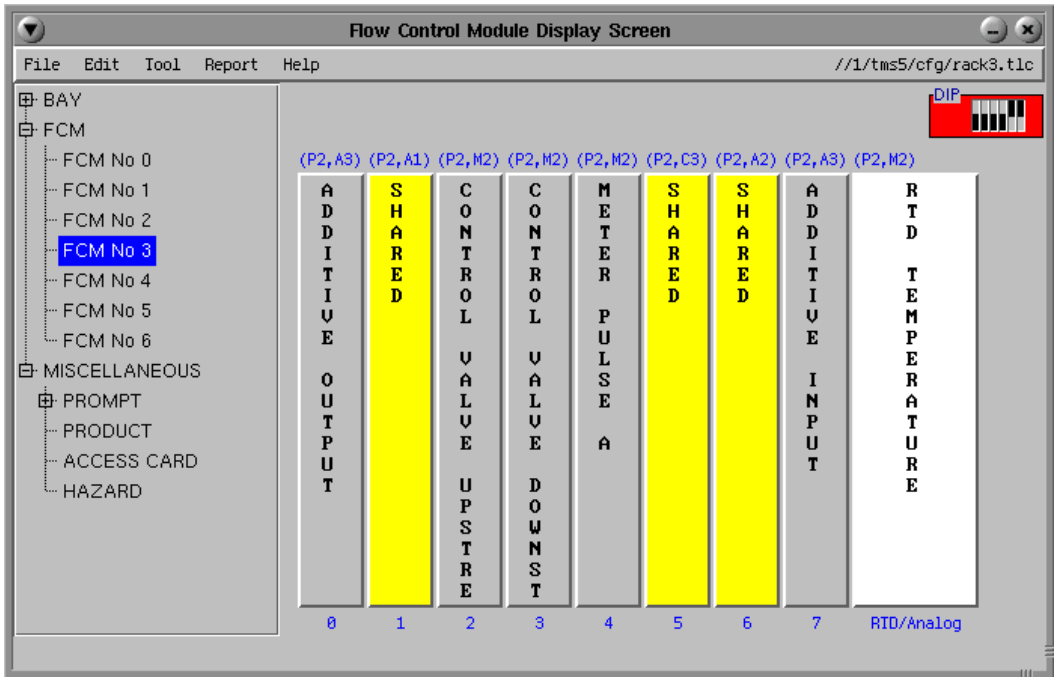


Figure 3.14 I/O Assignment Graphic

To view detail for a port, left-click on it. A detail window appears immediately to its right.

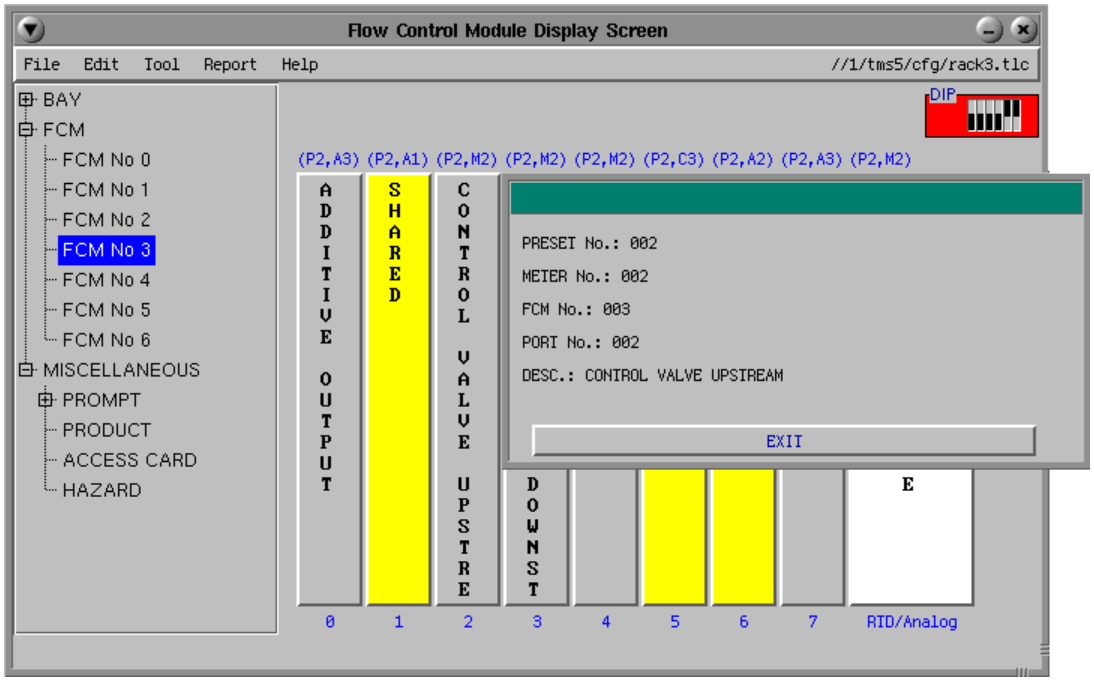


Figure 3.15 I/O Assignment Detail

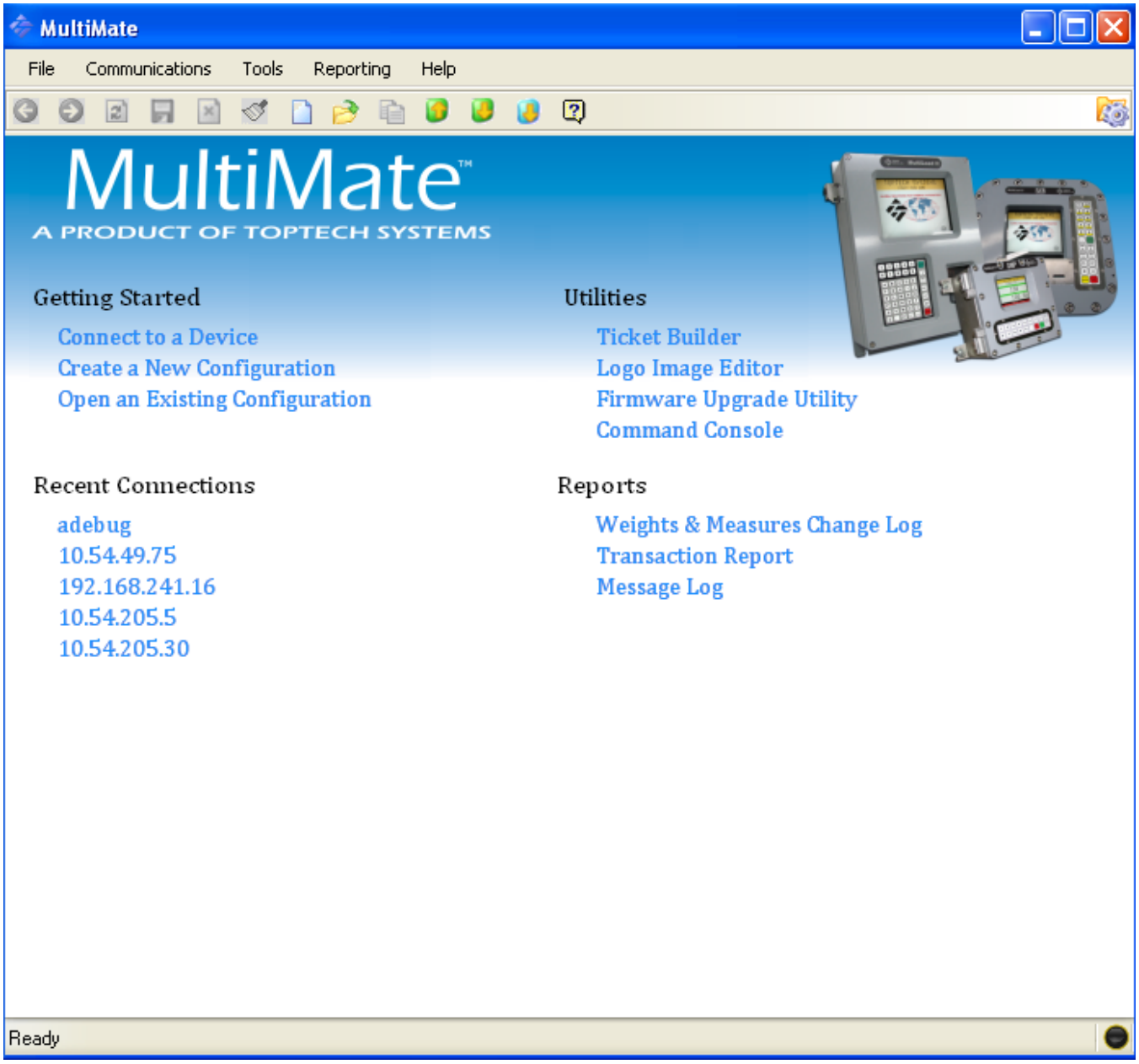
3.11 WINDOWS MULTIMATE CONFIGURATION TOOL

3.11.1 INSTALLATION

The MultiMate Configuration Tool program is typically distributed as a .ZIP file. The instructions below describe the proper procedure to install and run the software.

1. Extract the zip file
2. Execute the setup.exe follow the instructions carefully
3. Optional, delete the MultiLoad_cfg.zip file.
4. Execute the MultiLoad_cfg.exe program. The program window opens:
5. Open the program under the all programs folder:

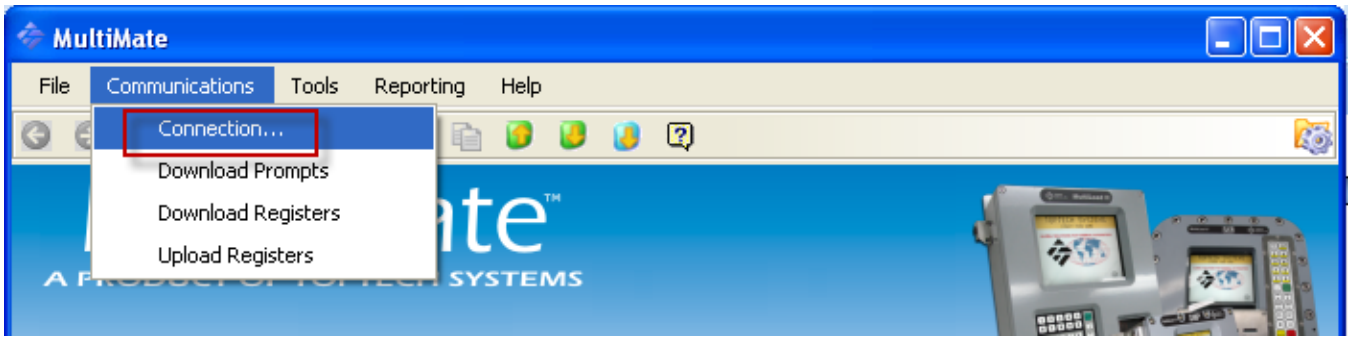
6. Following screen will appear


MultiMate
File
Communications
Tools
Reporting
Help
MultiMate™
A PRODUCT OF TOPTECH SYSTEMS
Getting Started
Connect to a Device
Create a New Configuration
Open an Existing Configuration
Utilities
Ticket Builder
Logo Image Editor
Firmware Upgrade Utility
Command Console
Recent Connections
adebug
10.54.49.75
192.168.241.16
10.54.205.5
10.54.205.30
Reports
Weights & Measures Change Log
Transaction Report
Message Log
Ready

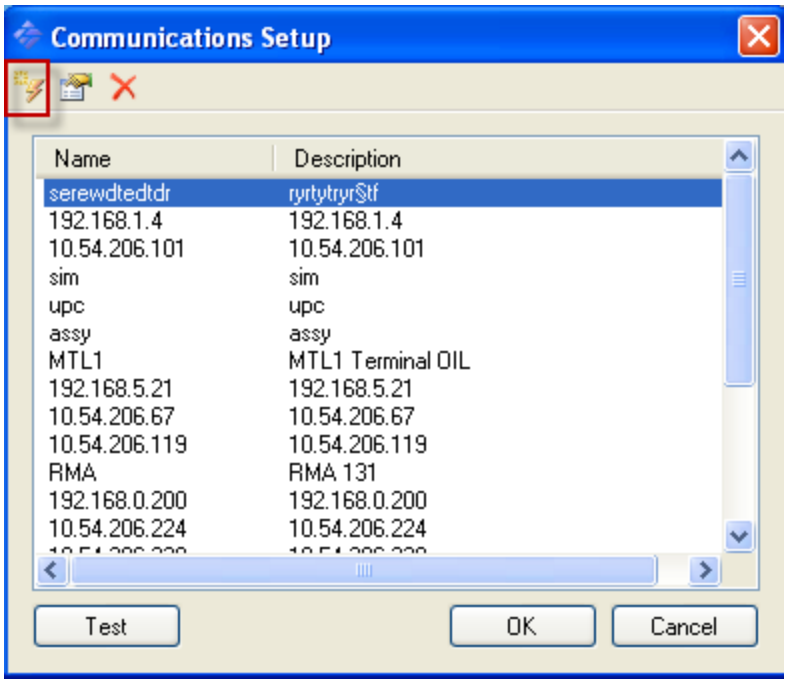
3.11.2 CONNECTION TO THE MULTILOAD II

Setup a connection to the MultiLoad II via serial, tms5/6 or ethernet

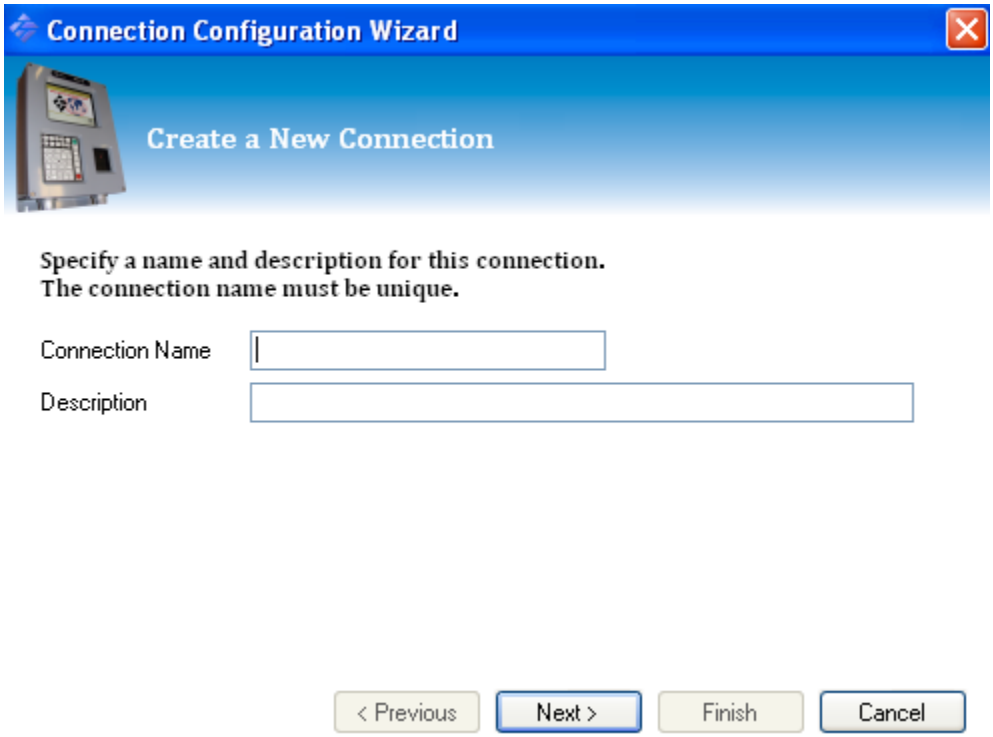
1. Go to the menu Communications and select Connection…



2. A new screen will pop up. In this screen in the left upper corner the button new connection should be pushed.

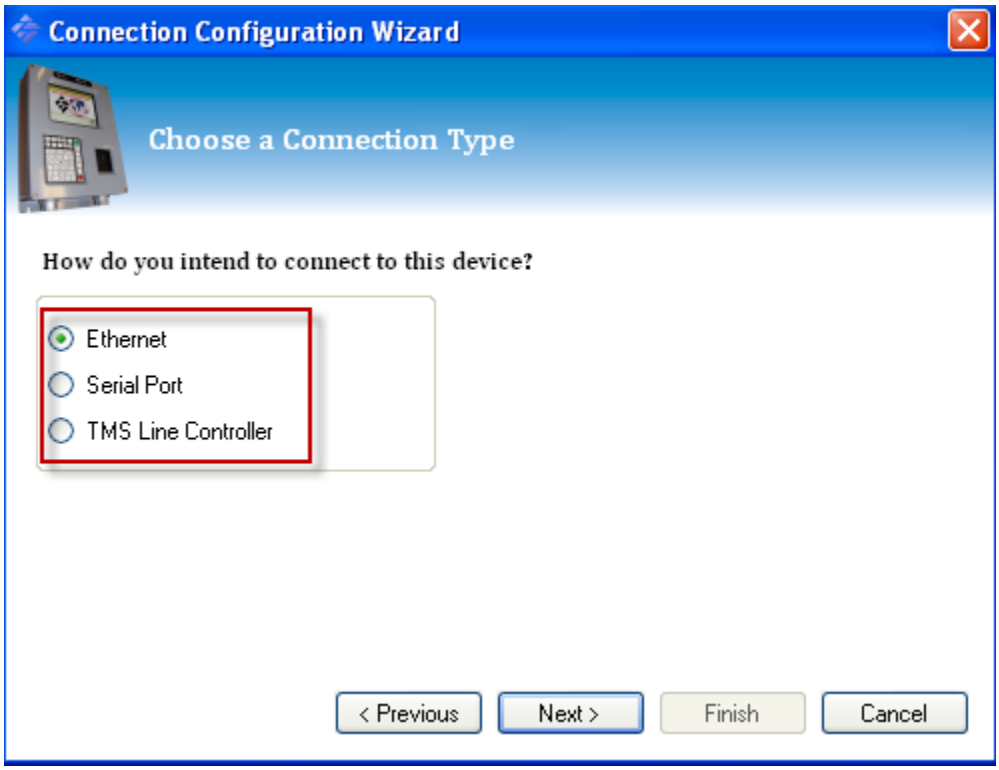


3. This will trigger the Connection Configuration Wizard. Follow this to create a connection to the Multiload.



4.

- Multimate supports three different ways to connect to a device:Ethernet
- Serial Port of your PC/Laptop
- Via your Tms5 or Tms6 system



Selecting Ethernet requires the IP address of the MTL.

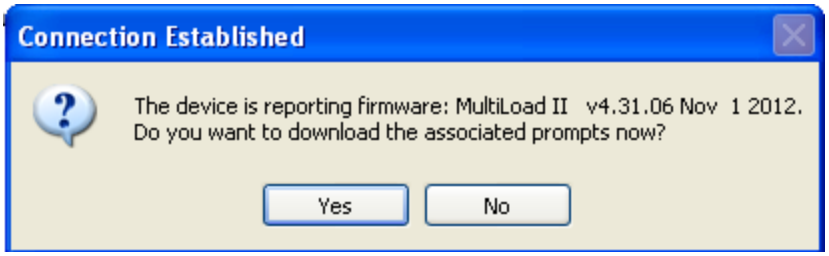
5. Confirming the IP-address will cause also a first check if the connection is working. The connection gets anyhow stored and can be reused when Multimate gets reopened.

3.11.3 DOWNLOAD PARAMETER PROMPT FILE

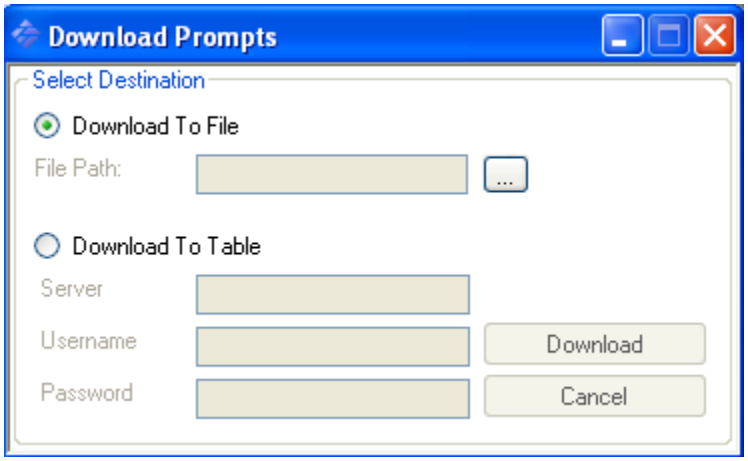
During the first install of the MultiMate Configuration Tool, there is no Parameter Prompt File. This file describes the all of the parameters that can be configured on the MultiLoad II. The prompt file must be downloaded from the MultiLoad II before any configuration files can be created, downloaded or edited. The instructions below describe the proper procedure to downloading the parameter prompt file from the MultiLoad II.

NOTE: The language of the parameters in the prompt file are determend by the configuration of the language mode in the Mutliload2.

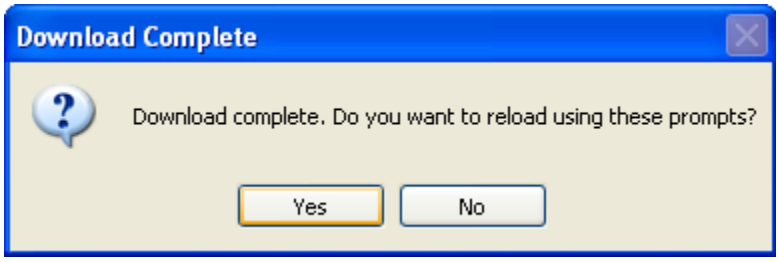
1. Connect via the just configured connection to Multiload (each time the connection will be established Multimate will ask to refresh the prompt list).


Connection Established
The device is reporting firmware: MultiLoad II v4.31.06 Nov 1 2012.
Do you want to download the associated prompts now?
Yes
No

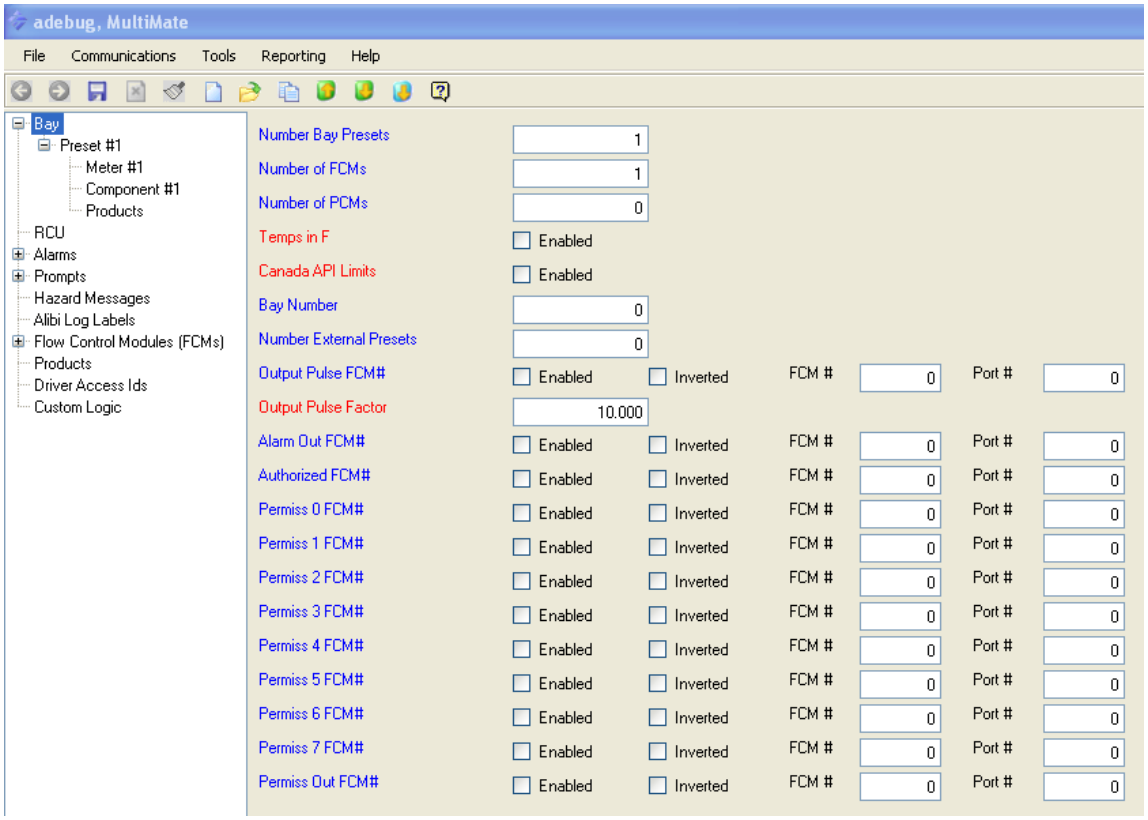
2. Store the prompt file in a certain location on your PC, or if available on your Tms6 System.



3. Answer the question reload the prompt file with a Yes. In that case we will use immediate the new prompt file.



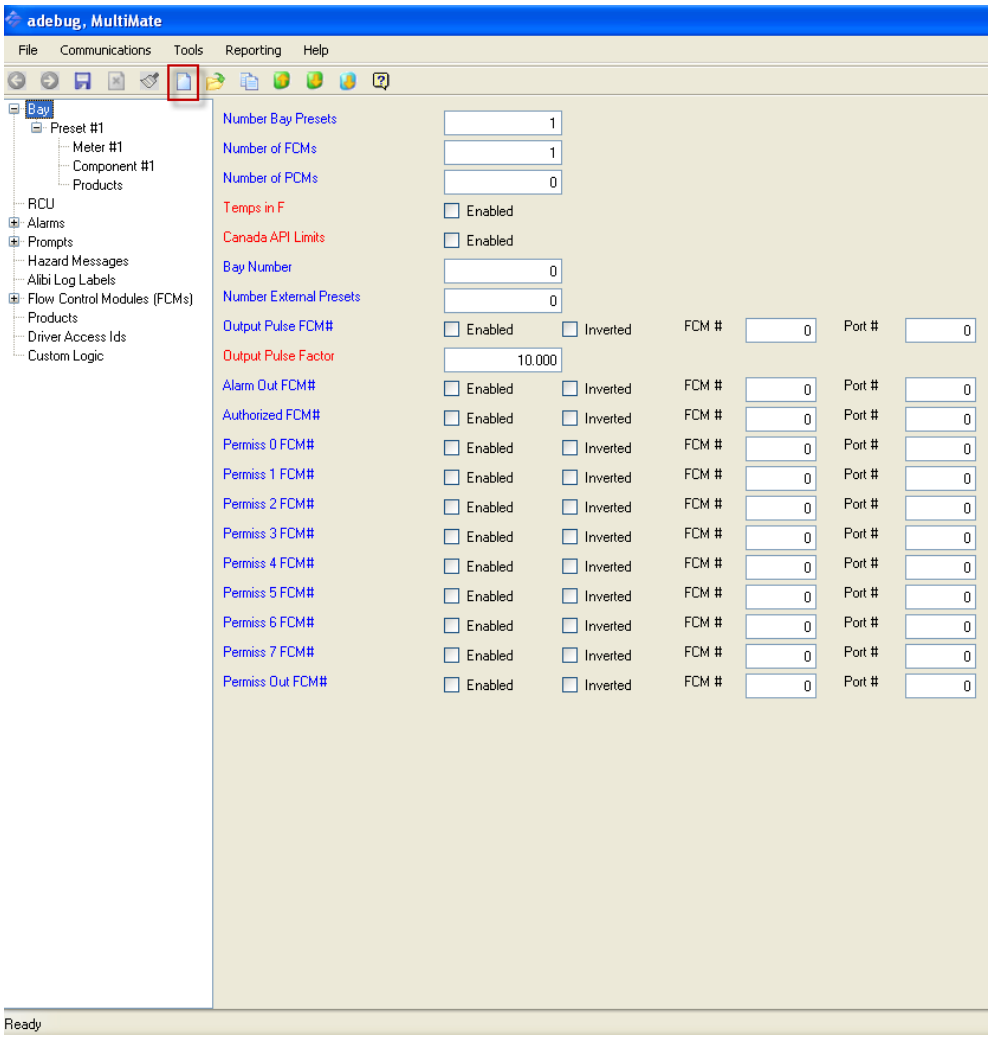
The configuration file gets available:


adebug, MultiMate
File
Communications
Tools
Reporting
Help
Bay
Preset #1
Meter #1
Component #1
Products
RCU
Alarms
Prompts
Hazard Messages
Alibi Log Labels
Flow Control Modules (FCMs)
Products
Driver Access Ids
Custom Logic
Number Bay Presets 1
Number of FCMs 1
Number of PCMs 0
Temps in F Enabled
Canada API Limits Enabled
Bay Number 0
Number External Presets 0
Output Pulse FCM# Enabled Inverted FCM # 0 Port # 0
Output Pulse Factor 10.000
Alarm Out FCM# Enabled Inverted FCM # 0 Port # 0
Authorized FCM# Enabled Inverted FCM # 0 Port # 0
Permiss 0 FCM# Enabled Inverted FCM # 0 Port # 0
Permiss 1 FCM# Enabled Inverted FCM # 0 Port # 0
Permiss 2 FCM# Enabled Inverted FCM # 0 Port # 0
Permiss 3 FCM# Enabled Inverted FCM # 0 Port # 0
Permiss 4 FCM# Enabled Inverted FCM # 0 Port # 0
Permiss 5 FCM# Enabled Inverted FCM # 0 Port # 0
Permiss 6 FCM# Enabled Inverted FCM # 0 Port # 0
Permiss 7 FCM# Enabled Inverted FCM # 0 Port # 0
Permiss Out FCM# Enabled Inverted FCM # 0 Port # 0

3.11.4 CREATE A CONFIGURATION FILE

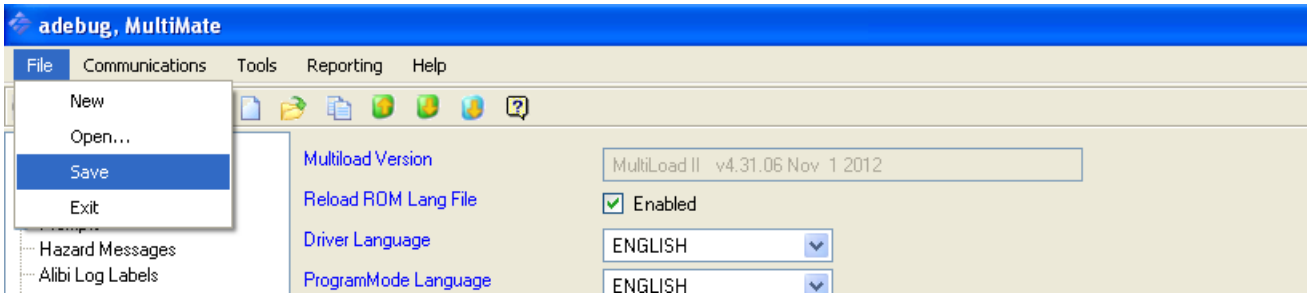
To create, edit and save Connection File should only be done when the correct prompt file is already on your machine

1. In the red rectangular the option to create a new configuration file is shown. Pushing it once will create a new file.

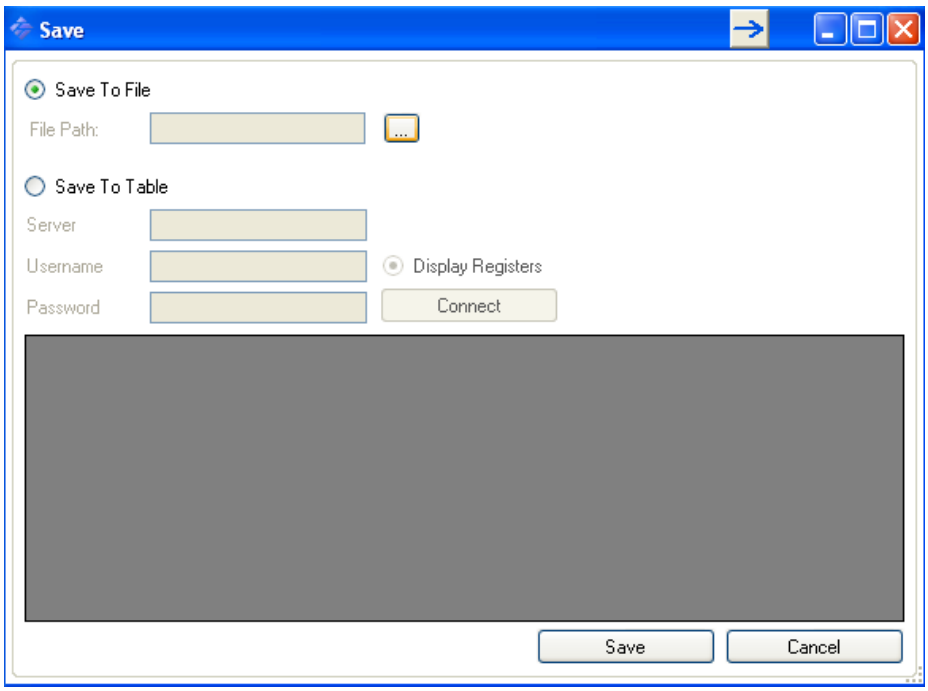


2. Making modification on the configuration file. Each parameter that is not equal to the default value will be shown in yellow.

3. Store the configuration file. Via the Menu File and Save.



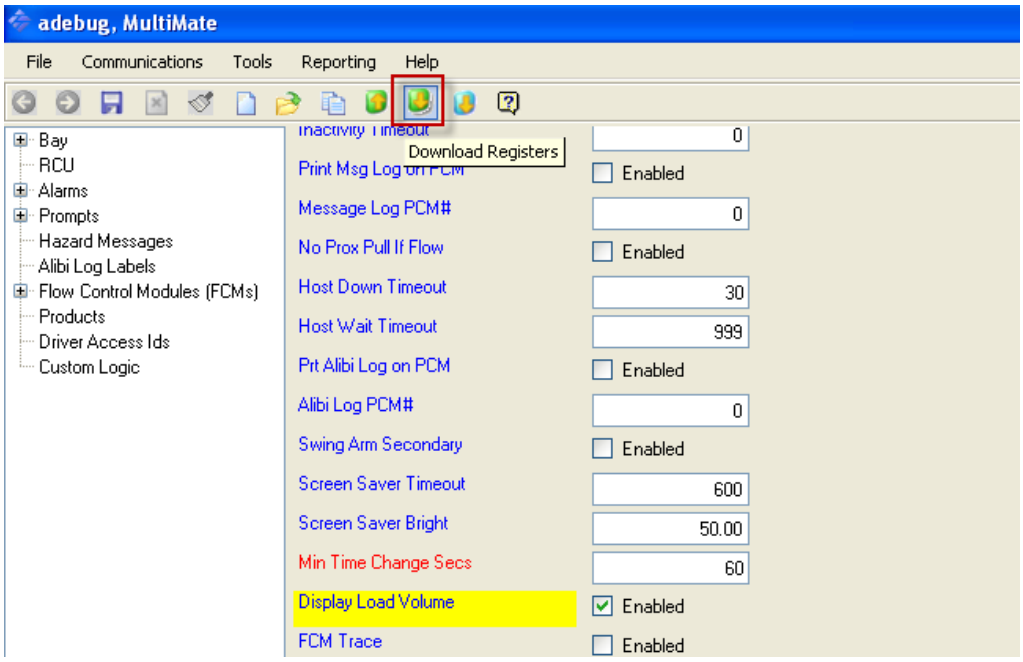
4. The file can be stored on your PC or on the Tms6 Server if available



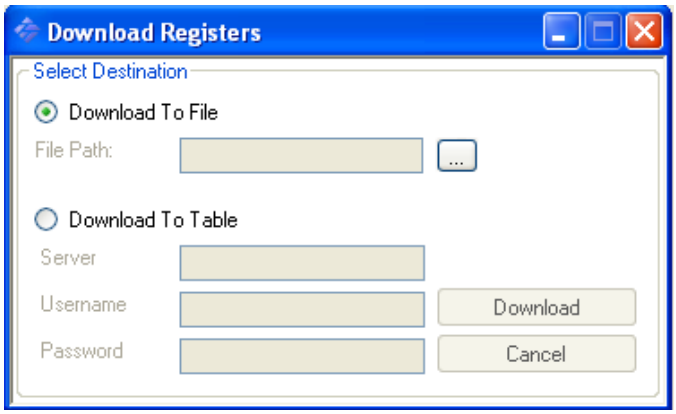
3.11.5 *DOWNLOAD A CONFIGURATION FILE FROM A MULTILOAD II*

To download a configuration file from a MultiLoad II.

1. Start the MultiMate program
2. Open a connection to a Multiload device (download prompts)
3. After downloading the prompts , the red highlighted button can be used to download all the config registers



4. Save the configuration file

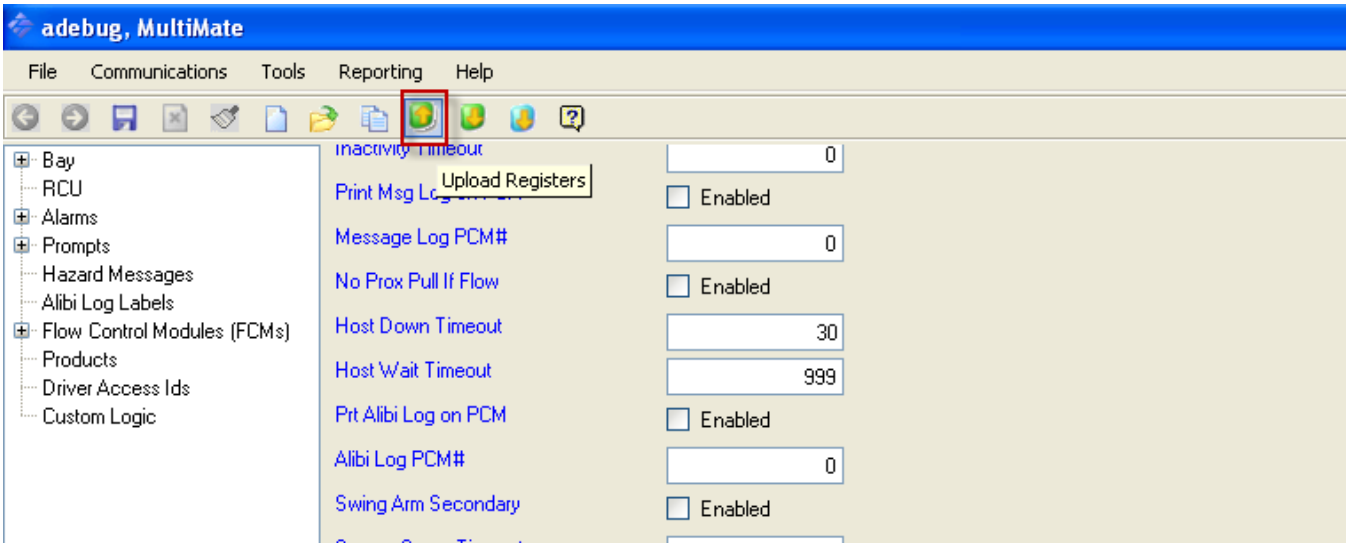


5. To verify that the download worked , the screen should show a lot of yellow lines. These are depending how many parameters are not matching the default
6. Re-opening afterward of the file can be done by starting MultiMate and go to File followed by the Open Menu.

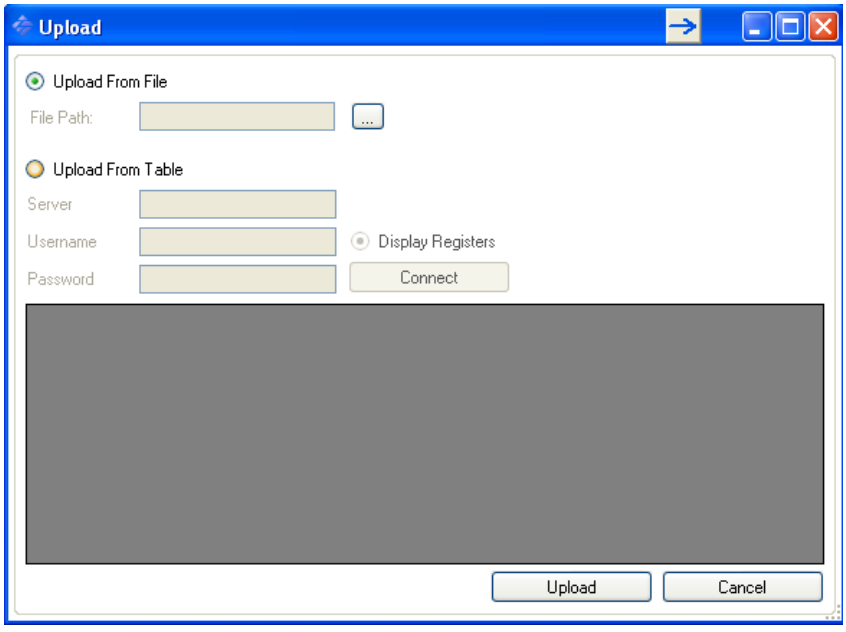
3.11.6 *UPLOAD A CONFIGURATION FILE TO A MULTILOAD II*

To upload a configuration file to a MultiLoad II.

1. Start the MultiMate program
2. Open the configured connection to the Multiload device (download prompts)
3. After downloading the prompts , the red highlighted button can be used to upload all the config registers



4. Open the configuration file that needs to be uploaded



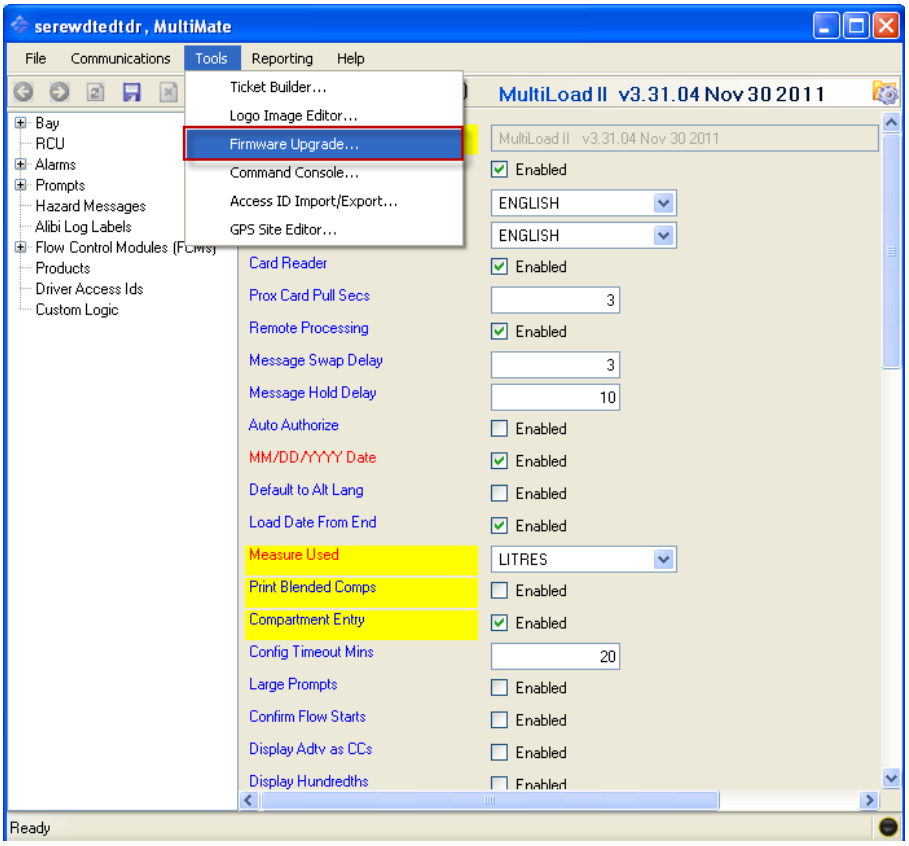
5. At the right bottom corner a progress bar will be visible , at 100 percent it is mandatory to check if the registers where correctly uploaded

3.11.7 UPDATE THE FIRMWARE IMAGE IN A MULTILOAD II

The process of updating the firmware image in a MultiLoad II occurs in two steps. The first step involves uploading the new firmware image to the MultiLoad II. This step may take a while but it can be done concurrently with normal loading operations. The Second step involves updating the flash memory with the new image and restarting the system. This step only takes about 10 seconds, but all loading operations and host communication must be discontinued during this operation.

To update the firmware image in a MultiLoad II.

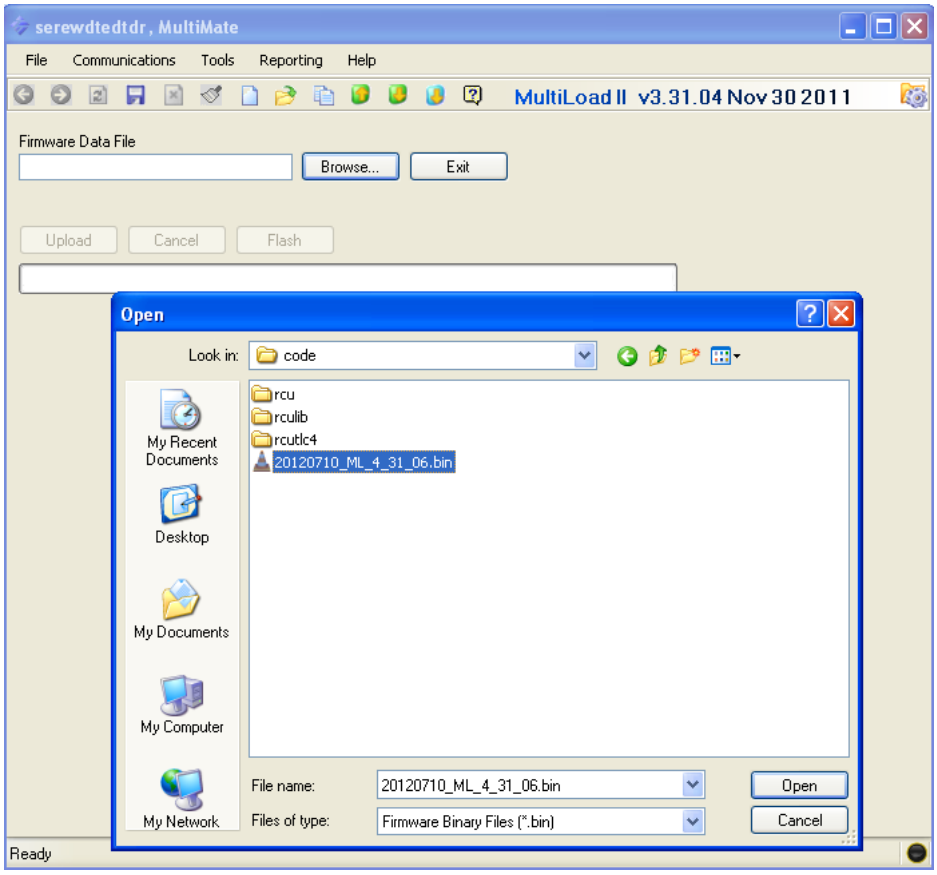
1. Start the Multimate tool
2. Create a new connection to the Multiload device.
3. .Select under the Menu tools the Firmware Upgrade option.



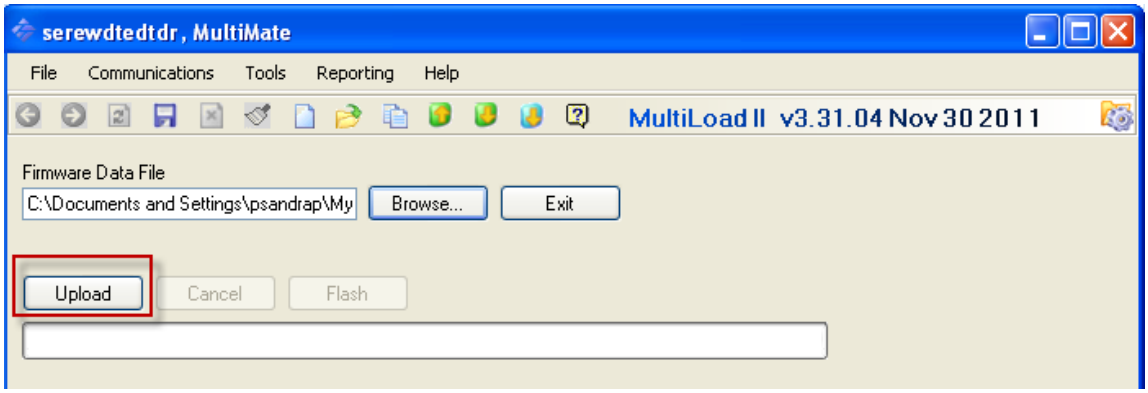
NOTE: When using a serial connection, at 115K Baud, firmware upload should take 25 minutes. At 56K firmware upload should take 50 minutes. At 9600 Baud, firmware upload should take 300 minutes.

NOTE: Some firmware updates MAY cause the configuration parameters and possibly the totalizer data to be set back to factory defaults. It is critical to download a fresh copy of the current MultiLoad II configuration before updating the firmware. Totalizers may be reset to zero.

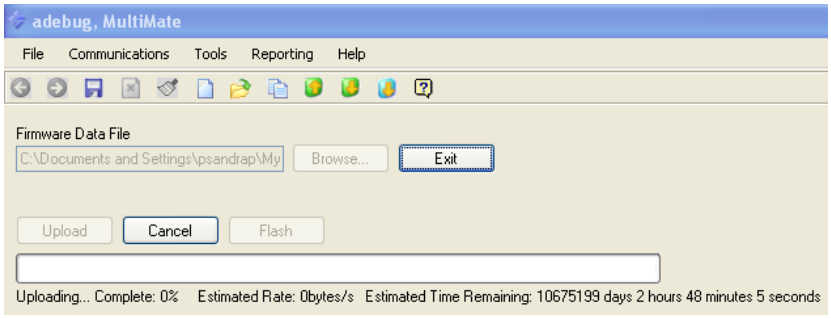
4. Before uploading the firmware, the user needs to select the bin file which needs to be uploaded.



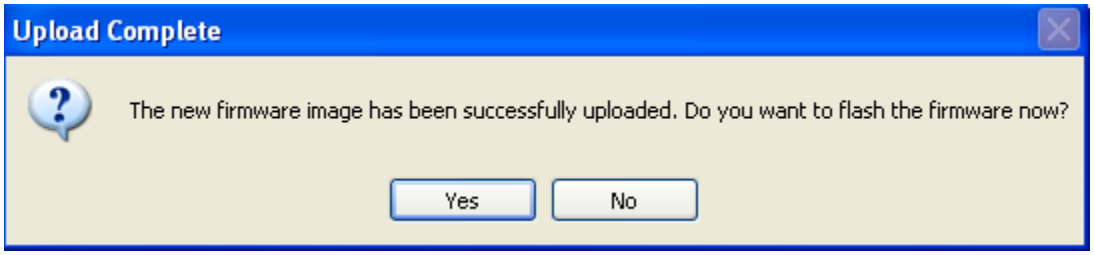
5. After selecting a valid bin file the option upload gets available



6. Uploading

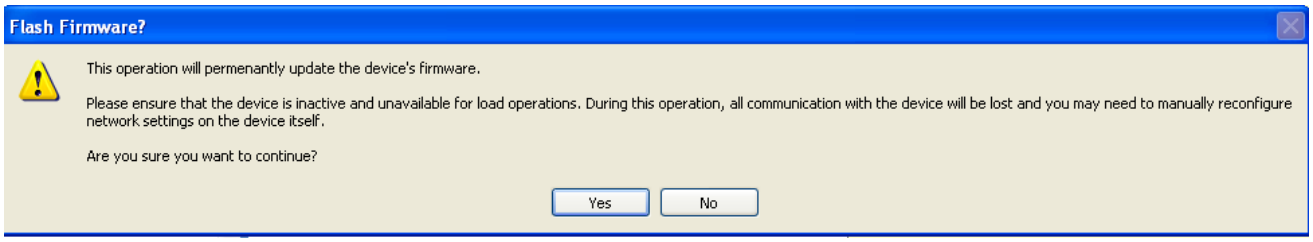


7. After the upload is completed the following pop up will appear. Update FLASH firmware



NOTE: If the W&M access switch is not active, the flash operation will fail since the firmware image is W&M protected.

8. Warning message that the settings could be lost, depending if the firmware step is small or big.


Flash Firmware?
This operation will permenantly update the device's firmware.
Please ensure that the device is inactive and unavailable for load operations. During this operation, all communication with the device will be lost and you may need to manually reconfigure network settings on the device itself.
Are you sure you want to continue?
Yes
No

9. After the upgrade the communication parameters should be re-entered to the Multiload.
10. Test the communication again via MultiMate and reupload the existing configuration.

NOTE: Legacy MultiLoad II 1-Arm firmware can be updated to the full MultiLoad II firmware version 2.29.02 or later.

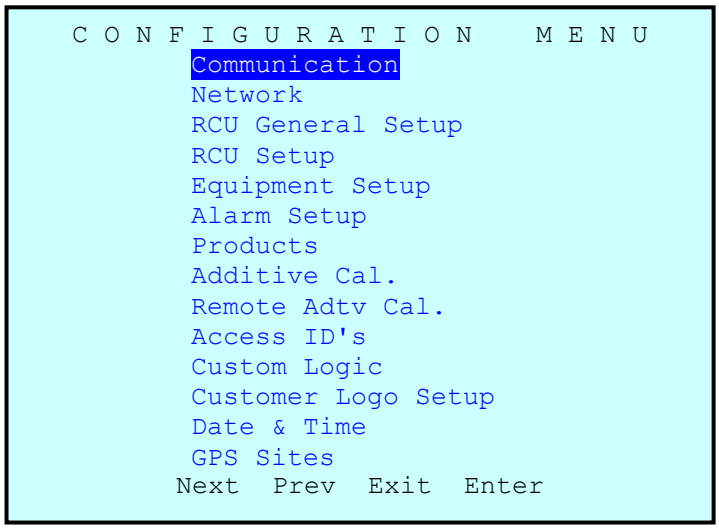
CHAPTER 4 GENERAL CONFIGURATION

4.1 OVERVIEW

MultiLoad II is highly configurable, which makes it extremely flexible and adaptable to your facility's changing needs. The MultiLoad II Configuration functions are available from the Configuration Menu.

Navigate to this screen as: Program Mode -> Configuration

The CONFIGURATION MENU screen displays:



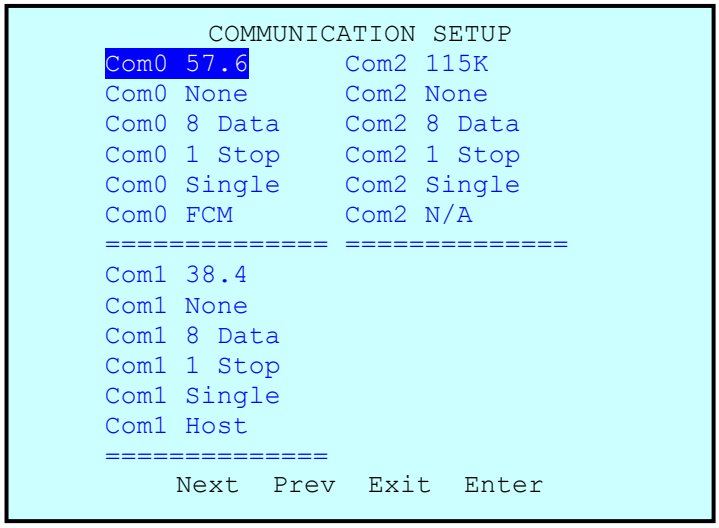
With the exception of Additive setup and calibration functions, all configuration functions and features are discussed in this chapter in the order they appear on the Configuration Menu. Functions related to Additive configuration and calibration is covered separately later in this manual.

4.2 COMMUNICATION SETUP

Use the Communication Setup function to define the communication parameters for each serial communication port.

Navigate to this screen as: Program Mode -> Configuration -> Communication

The COMMUNICATION SETUP screen displays:



The three parameter groups correspond to the three available Communications ports: Com0, Com1 and Com2.

Starting with Com0, work your way down the list, modifying the communication parameters as necessary. Press the Enter button to toggle the selection on each field. Press the Next button to move to the next parameter.

When you finish Com0, continue with Com1 and Com2.

When you are finished, press Exit to save the changes and return to the Configuration Menu.

Parameter	**Description**
line 1 – Baud Rate	Select the baud rate. Choices are 300, 1200, 2400, 4800, 9600, 19.2 (for 19,200) 38.4 (for 38,400), 57.6 (for 57,600), 115.2 (for 115,200) and 230 (for 230,400) baud.
line 2 – Parity	Select the parity. The choices are None, Odd, and Even.
line 3 – Word size	Select the word size, defined in bits. The choices are 7 and 8.
line 4 – Stop bits	Select the number of stop bits. The choices are 1 and 2.
line 5 – Tri-State	To define Tri-stating, select Multi or Single. For Com 0 and Com 1, options are Single, Multi, and 2-wire. Com 2 is always Single. These three options are described below: **Single** Select this choice when the following two conditions are met. 1. Only one MultiLoad II will be on the circuit 2. The circuit is 4-wire, RS-485 **Multi** Select this choice when the following two conditions are met 1. More than one MultiLoad II will be on the circuit 2. The circuit is 4-wire, RS-485 **2-Wire** Select this choice when using a 2-wire RS-485 circuit. Multi dropping is permitted with this choice. Toptech recommends using the Single, 4-wire method whenever possible. Multi dropping on 4-wire or 2-wire may not be feasible for large installations.

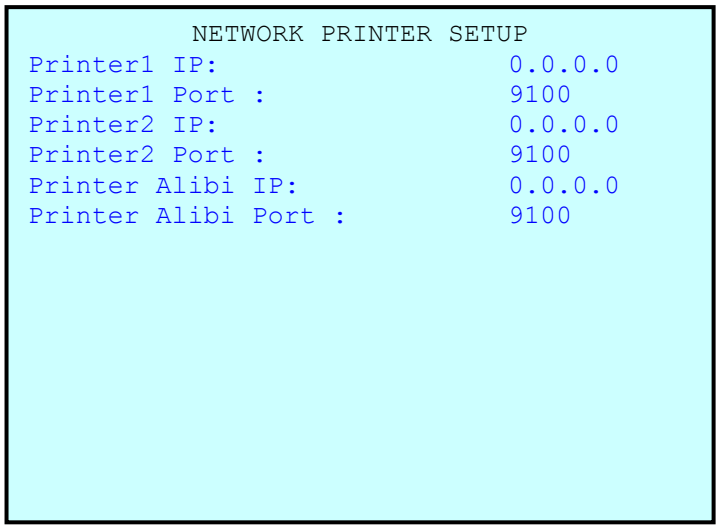
Parameter	Description
line 6 – Port Usage	Specify how the port is to be used. Choices are: **FCM** will communicate to the external FCMs (excluding SMP) or optional internal I/O board — Default for Com0 **Host** will communicate to a TMS — Default for Com1 **N/A** (not applicable) — Default for Com2 **Print** indicates the printer port **Log** sends message log to serial printer **Ethernet** allows the Host (TMS) to communicate with the serial port over the Ethernet via the socket address shown on the Network Setup Screen (7000 to 7002) **Alibi Log** indicates the Alibi Log port **PTB Alibi** indicates the PTB Alibi Log port **GPS** indicates the NMEA 0183 protocol GPS Port . (ML II Mobile Only) **MASS MTR** indicates a serial connection to one or more mass meters When Print or Alibi Log is configured to be on COM 2, the CTS handshake line MUST be connected or a *PRNTR ERR will be raised preventing loading. See the installation manual for COM 2 connection information. Only one port may be defined as a **FCM, Print**. or **Alibi Log**, otherwise, a 'Port usage conflict(s)' message will display upon re-boot. When a port is configured as GPS, the last three transaction prompts will be populated with Latitude, Longitude and Site Name Information. Exiting program mode is required to have the new setting take effect. It is possible to use 2 host ports at the same time, but the host system should only talk with one of the two ports at the same time! To learn more about the Message Log selection, see: Views and Inquiries

4.3 NETWORK SETUP

Use the Network Setup function to define the network parameters for the Ethernet port.
Navigate to this screen as: Program Mode -> Configuration -> Network
The NETWORK SETUP screen displays:

```
                NETWORK SETUP
MAC Address:          00:50:c2:60:90:00
Network:              DISABLD
IP Address:           192.168.0.200
IP Mask:              255.255.255.0
IP Gateway:           192.168.0.1
IP Host:              192.168.0.1
Socket Port:          7734
Com 0 Port:           7000
Com 1 Port:           7001
Com 2 Port:           7002
Webpage Setup
Network Printer Setup


          Next  Prev  Exit  Enter
```

```
                WEBPAGE SETUP
HTTP Port:            80
Admin Password:       *******
User Password:        *******









          Next  Prev  Exit  Enter
```



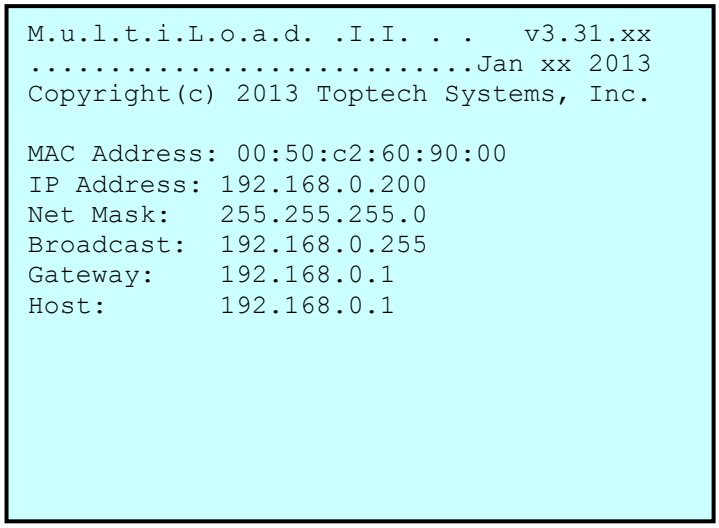
After changes are made in this screen, exiting program mode is required for the changes to take effect.

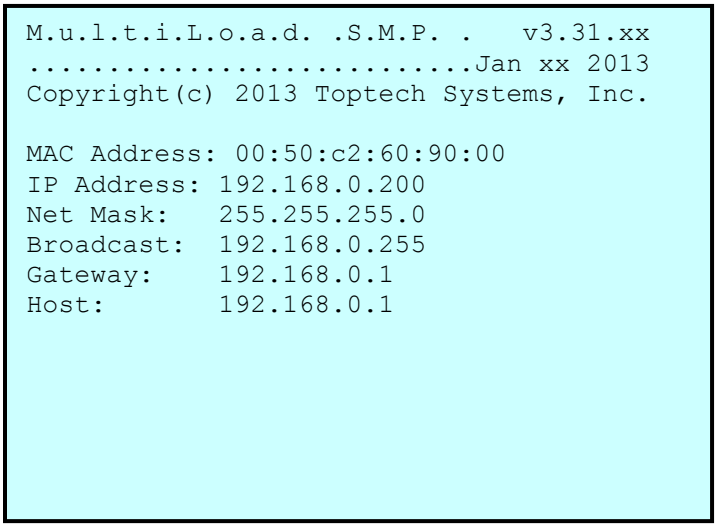
Parameter	Description
MAC Address	This is a read only parameter and indicates the hardware MAC address of the Ethernet port. This number is unique, assigned at the factory and cannot be modified.
Network	Enables or Disables the Ethernet port. If the Ethernet port is enabled with no network connected, startup may have a 10-20 second delay while the connection is checked.
IP Address	Static IP address assigned to the unit. This value should come from the local network administrator and should be unique to the local network. Dynamic IP address (DHCP) is not supported.
IP Mask	The IP mask used to determine if an IP address is in the local network, or is on the other side of the Gateway. Default is 255.255.255.0
IP Gateway	The IP address of the network gateway used to access IP addresses outside the local network.
IP Host	IP address of the Host (TMS) system. This address is used during Network Diagnostics to set ping packets to the host computer.
Socket Port	This is a read only parameter and indicates the socket port number (7734) the Host (TMS) system must connect to establish a serial connection across the serial port. The type of socket connection is a SOCKET_STREAM.
Com 0 Port	Read only parameter indicating the socket address the Host (TMS) will use to communicate with this serial port if it is configured as INTERNET. (7000)
Com 1 Port	Read only parameter indicating the Socket address the Host(TMS)will use to communicate with this serial port if it is configured as INTERNET. (7001)
Com 2 Port	Read only parameter indicating the Socket address the Host(TMS)will use to communicate with this serial port if it is configured as INTERNET. (7002)
HTTP Port	The Socket address client computers will use to contact the built in HTTP server. A value of 0 disables the HTTP server. Default is 80.
Admin Password	Password for the Admin user. Admin has read-write access, means access to rcuditto with keypad and upload files. The admin user name is “admin” (lower case)
User Password	Password for the User. User has read access, means access to rcuditto with no keypad and is not allowed to upload files. The user user name is “user” (lower case)
Printer1 IP	To print a ticket to a network printer give the IP address in of that Printer

Parameter	Description
Printer1 Port	This port is set fixed to 9100 (standard raw-protocol)
Printer2 IP	To print a ticket to a network printer give the IP address in of that Printer. If Printer 1 and Printer 2 are used we will send at each printer one copy. If both IP addresses are the same 2 copies will come out of the same Printer.
Printer2 Port	This port is set fixed to 9100 (standard raw-protocol)
Printer Alibi IP	Printing to a PTB protocol PC or network Printer
Printer Alibi Port	This port is set fixed to 9100 (standard raw-protocol)

Note: The password for both is default Toptech (lower case) , if the password is changed by the keypad of the Multiload2 it is always capital. If it is changed by the web-interface it handles lower as capital case.

After enabling the network and rebooting the MultiLoad II, the two network activity lights next to the Ethernet connection should become active indicating network activity and link status. The Boot Screen will display as:





For security reasons, IP Address information will only be displayed when the network is first enabled and on power up.

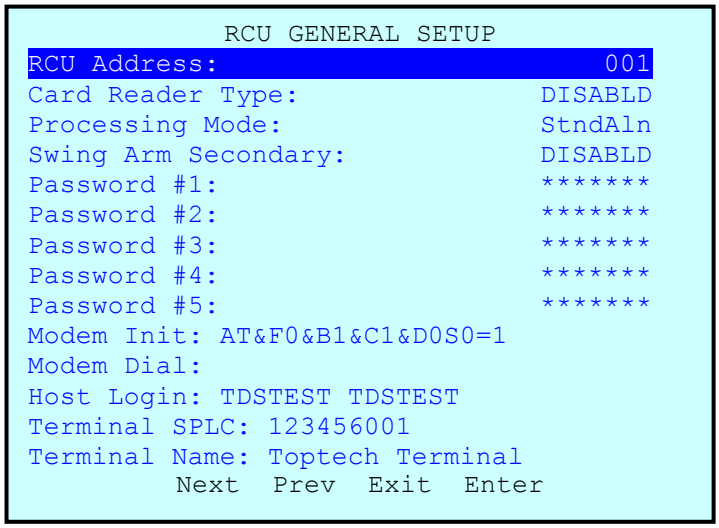
4.4 RCU GENERAL SETUP

Use the RCU General Setup function to:

- Specify the RCU communication address.
- Enable or disable: remote processing by a TMS.
- Assign passwords for entering the MultiLoad II configuration mode.

Navigate to this screen as: Program Mode -> Configuration -> RCU General Setup

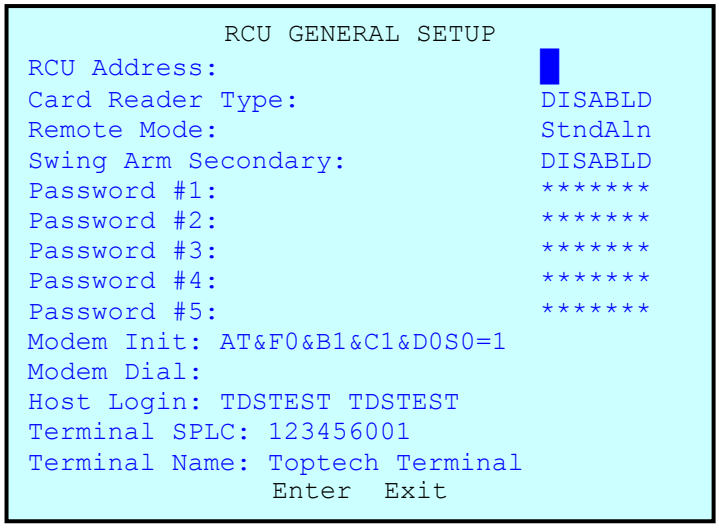
The RCU General Setup screen displays:



RCU Address is a data entry field. Press **Enter** and key in the appropriate address value. Then press **Enter** to save the value.

Remote Processing are toggle fields. Use **Next** or **Prev** to highlight the appropriate filed. Press **Enter** to access the field, then **Next** or **Prev** to change the setting. Press **Enter** to save the change.

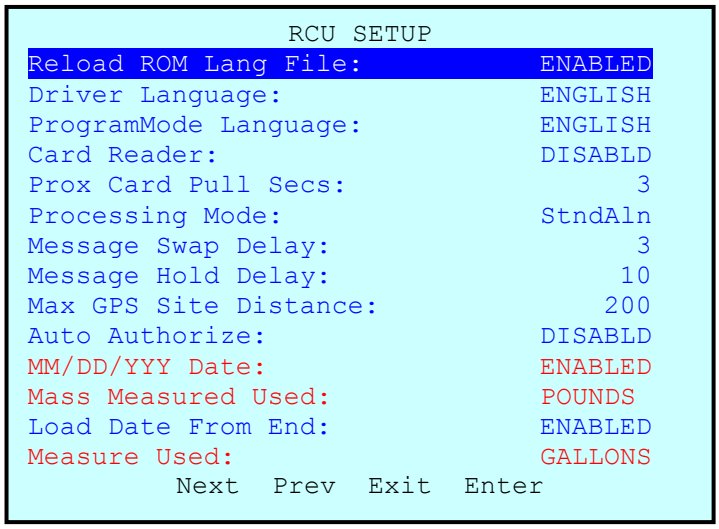
Password is a data entry field. Press Enter and key in a new password. Press **Enter** to save the change.



Parameter	Description
RCU Address	Address of the MultiLoad II RCU unit. The values are 001–099.
Card Reader Type (Excluding SMP)	Enable or Disable the card reader. If enabled following options are possible: • BUCKET • BUCKET NON CAPTIVE • SLOT • SLOT NON CAPTIVE • iBUTTON
Remote Processing	Remote, StndAln (which means Standalone), other modes are possible as UAP depending on the needs.
Swing Arm Secondary (Excluding SMP)	When swing arms are used, one bay RCU will be designated as the secondary RCU. Enable this parameter to identify the RCU as secondary. When this parameter is disabled, the RCU will be considered primary for swing arm purposes. If no swing arms are involved in the bay, disable this parameter.
Password	Program Mode password. There may be up to five passwords entered. Each password can consist of seven alphanumeric characters. The terminal manager should assign a password to each person/group. For example, employee #1 will be password #1. When employee #1 accesses the Weights & Measurements Menu, his code will be part of the change log event. It will say "ID: 1 has Weights & Measurements Menu Access". Any changes made in the log will be prefaced with the ID#.
Modem Dial	(This feature has not yet been implemented.)
Host Login	(This feature has not yet been implemented.)
Terminal SPLC	Terminal SPLC code for Host System (for example TDS)
Terminal Name	Enter the name of the terminal or depot in this field. This name will be printed on Alibi logs and Meter Tickets, if they are enabled.
Truck Number	UAP Setting
Carrier ID	UAP Setting
TDS Retry Interval	Time in second that Multiload will reach into the cloud
Seller ID	UAP Setting
Consignee	UAP Setting
BOL Prefix	UAP Setting

4.5 RCU SETUP

Use the RCU Setup function to configure how the MultiLoad II RCU unit will function.
Navigate to this screen as: Program Mode -> Configuration -> RCU Setup
All Weights and Measures controlled values are displayed in red both on the screen and in this manual.
The RCU Setup screen displays:



Using the field descriptions below, make any necessary changes.
When you are finished with MultiLoad Setup, press **EXIT** to save your changes and return to the Configuration Menu.

Parameter	Description
Reload ROM Lang File	Enabling this parameter will enable the alarm and status labels to the factory defaults on reboot.
Driver Language	Specify the Language, English, Spanish, Portuguese, French, German, Mandarin(Old and New) or Thai to be displayed to the driver.
Program Mode Language	Specify the Language English, Spanish, Portuguese, French, German, Mandarin (Old and New) or Thai, to be displayed in program mode.
Card Reader	Indicates whether a card reader is configured for use or if the device is to be used as keypad only. Select card reader mode : • BUCKET • BUCKET NON CAPTIVE • SLOT • SLOT NON CAPTIVE iBUTTON When Disabled, the MultiLoad II will prompt the driver to 'Press Next to Begin" for login. The driver then keys in his card number and PIN.

Parameter	Description
Prox Card Pull Secs	This number indicates the time period, in seconds, that a proximity card must be removed (pulled) before the MultiLoad terminates the transaction. This parameter can be increased from zero in order to alleviate the effects of site generated Electro-Magnetic Interference (EMI). In some cases, external EMI can cause the MultiLoad II to think that the proximity card has been removed, resulting in a prematurely aborted transaction.
Processing Mode	When this parameter is Remote the MultiLoad II is in remote processing mode; and will operate under the control of a MultiLoad. When the parameter is StndAln the MultiLoad II is in local, stand-alone operation.
Message Swap Delay	Number of seconds to delay before toggling the Idle prompt. The Idle prompt is typically “For Access, Press Next to Begin” or “For Access, Insert Driver Card”.
Message Hold Delay	Number of seconds that a message is delayed after a ESC D command. This register is only used for temporary displays by MultiLoad.
Max GPS Site Distance	Distance in meters that the current position must be to a GPS site in the database to be considered located at that site. When this value is 0, site location lookup and enforcement is not done. (ML II Mobile Only)
Auto Authorize	Enable this parameter to bypass security prompts. This parameter is intended for stand-alone operation, when no terminal automation system is used to provide remote authorization and when the MultiLoad II is in a secure location. When enabled, the MultiLoad II will always remain in an authorized state. The Load Screen will always be displayed, permitting an operator to select an arm and start loading without entering Identification or PIN data. The Load Screen will be displayed whenever the Program Key is in the off position. To enter Program Mode, activate the Program Key and press **EXIT** two times. Then follow the normal procedure to enter Program Mode. After exiting Program Mode, turn off the Program Key to automatically return to the authorized state.
MM/DD/YY Date	When enabled dates will appear on tickets as MM/DD/YY instead of DD/MM/YY.
Mass Measure Used	Product mass measurement units to be displayed. It is mandatory when loading in mass that this register is correctly populated.
Load Date From End	Load date from end means that the load date of the transaction will be the date at the end of the load. For instance if a transaction takes place across midnight, this parameter will control whether the load date is the date at the beginning of the transaction or the end of the transaction.
Measure Used	Product measurement units to be displayed.
Print Blend Details	Controls the printing and archiving of transaction additive, component and meter values. 0 = No additive, component or meter values. 1 = All additive and component values. Meter data only when values are different from the component data. 2 = All additive, component and meter values..
Compartment Entry	If enabled, the MultiLoad II will prompt the driver for a compartment entry for each batch. This compartment data is stored with the transaction.
Config Timeout Mins:	Configuration timeout minutes is the number of minutes that the program mode will stay in operation without a user keystroke. If this parameter is set to non-zero, program mode will reset to operation mode after this parameter number of minutes expires without a keypad keystroke.
Print Totalizers	Enables the recording of ending totalizer values in the transaction for (P)reset, (M)eter), (C)omponent and (A)dditives.

Parameter	Description
Simulation Mode	If enabled, will place the MultiLoad into a Simulation Mode for demo and test purposes. In this mode a flashing "Simulation Mode" message will display on the load screen notifying the operator that simulated loading is occurring. All FCM or I/OBoard product and additive operations will be simulated in the firmware. No actual FCM or I/O Board hardware needs to be present while in this mode.
Large Prompts	If enabled, will force idle toggle message, and all standalone prompts ("Enter Access ID", "Enter PIN", and all custom prompts) to appear in large fonts. Note: Toggle messages over 20 characters in length will not appear in large fonts.
Confirm Flow Starts	If enabled, the user is prompted a second time before starting flow.
Display Adtv as CCs	Enable to display additive amounts in cc units. Disable to display additive amounts in base units, that is, gallons or liters.
Display Hundredths	Enable to display 100s of whole units. This also occurs when in meter proving mode. Transaction and Totalizer resolution are still in whole units when this parameter is enabled.
Use Hundredths	Enable when 1/100 resolution is needed in the displaying, totalizing and recording of delivered transaction volumes. When this parameter is enabled, it will override (force on) the Display Hundredths parameter. View Totalizer and View Transaction screens will display 1/100 resolution. NOTE: When this parameter is enabled, the Host register interface (serial and Ethernet) will return volume data with an implied 2 decimal places for totalizers, transaction details (not additive) and current delivered volume (MRS command). Configuration or program changes in the host system may be needed when using this option. See the MultiLoad communications manual for more details.
W&M Density Lock	Enable this parameter to W&M protect the parameters density, relative density and API Gravity on meter as on component level. Also the communication update to these parameters is blocked.
Print Ticket	Enable this parameter to print a Meter Ticket from the serial printer port.
Form Feed After Tckt	This parameter is used in conjunction with the Ticket Print function. If this parameter is enabled, the MultiLoad II will send a form feed after each Ticket Print.
Print Ticket on PCM	Enable this parameter to print a meter ticket thru a Printer Control Module (PCM). A meter ticket is a printed record of the transaction. After enabling this parameter, go to parameter "Ticket PCM#" and assign a PCM.
Ticket PCM#	This parameter designates the Print Control Module (PCM) that will be used as a serial port to send Meter Ticket data to a printer.
Meter Arch Timeout	Amount of time (in seconds) that MultiLoad II will wait for the Host system to retrieve current load data before totals are cleared. This parameter is only valid for Remote Mode.
Inactivity Timeout	This feature is only applicable when operating in stand-alone mode; no supervisory computer is regulating transaction time. If no flow activity or button presses have occurred in the time specified by this parameter, the transaction will be terminated and any deliveries will be archived. Inactivity Timeout will not occur if either the program or Weights and Measure switches are activated or if in the Proving Mode. Enter a value of zero to disable this feature. Valid range of entries is 0-60 minutes.
Print Msg Log on PCM	Enable this parameter to print a Message Log thru a Printer Control Module (PCM). A Message Log is a record of all activities and alarms on the MultiLoad II and is typically used for troubleshooting. After enabling this parameter, go to "Message Log PCM#" and assign a PCM.
Message Log PCM#	This parameter designates the Printer Control Module (PCM) that will be used as a serial port to send Message Log data to a printer.

Parameter	Description
No Prox Pull If Flow	When this parameter is enabled, pulling the proximity card from the captive reader will not terminate the transaction if flow is occurring. Sequential blends continue to completion. When flow stops on all arms and the proximity card is missing from the reader, the transaction will be ended and all loads will be archived for data retrieval. When disabled, all loads will be stopped and archived immediately after the proximity card has been pulled.
Host Down Timeout	The time in seconds that the MultiLoad II will wait before entering a HOST DOWN state after not receiving communications from MultiLoad. This parameter is only valid if the MultiLoad II is operating in Remote Mode.
Host Wait Timeout	The time in seconds that the MultiLoad II will wait before entering a HOST DOWN state after not receiving communications from MultiLoad after receiving a FHOSTWAIT command. This parameter is only valid if the MultiLoad II is operating in Remote Mode.
Prt Alibi Log on PCM	Enable this parameter to print an Alibi Log from a Print Control Module (PCM). An Alibi Log is a record of all transactions that are recorded by MultiLoad II. After enabling this parameter, go to “Alibi Log PCM#” and assign a PCM. Also the unauthorized flow , will be printed to a voucher
Alibi Log PCM#	This parameter designates the Print Control Module (PCM) that will be used as a serial port to send Alibi Log data to a printer.
Swing Arm Secondary (Excluding MultiLoad)	When swing arms are used, one bay MultiLoad will be designated as the secondary MultiLoad. Enable this parameter to identify the MultiLoad as secondary. When this parameter is disabled, the MultiLoad will be considered primary for swing arm purposes. If no swing arms are involved in the bay, disable this parameter.
Screen Saver Timeout	The time in seconds that the backligh screen saver turn on when the MultiLoad II is idle.
Screen Saver Bright	The brightness in percentage that the backlight will illuminate when the backlight screen saver turns on.
Min Time Change Secs	Min Time Change Secs: Before the beginning of each transaction, TMS will attempt to synchronize the date and time of the MultiLoad II with the date and time of the TMS computer. TMS will update the date and time of the MultiLoad II if the difference between the TMS system time and MultiLoad II time is greater than the value of this parameter. Enter a value in seconds. The date and time of MultiLoad II will not be updated unless the Weights and Measures switch is activated.
Display Load Volume	When this parameter is enabled, the sum of all volumes delivered in a transaction will appear at the bottom of the Load Screen. The text “Total Delivered” will be displayed immediately below the last load arm listed on the load screen. This total will be reset to zero when the transaction has been ended by pulling the card or pressing Exit at the Load Screen twice.
FCM Trace	Enable or Disable. **This parameter is used for advanced troubleshooting. Please do not enable this parameter without direction from Toptech Systems Engineering.**
Measure on Load Scrn	Enable this parameter to display a units designation that will be visible on the Load Screen, adjacent to each load arm. Unit designations are as follows: Gallons = g, Liters = L, Cubic Meters = c, Tons = t, Kilograms = k, Grams = G, Pounds = p, Barrels = B.
Status Scrn Lockout	Enable this parameter if it is desired to prevent the driver or operator from viewing the Status screens. When this parameter is enabled, the driver will be able to view only two screens. One is the Load Screen, which lists all of the load arms or presets. The other screen that will be available is the Control Screen, which displays the preset quantity and the remaining quantity of the selected load arm. To aid troubleshooting, terminal personnel can temporarily deactivate this feature by enabling the Program Key switch. This will allow technicians to view the status screens during loading, without changing the parameter.

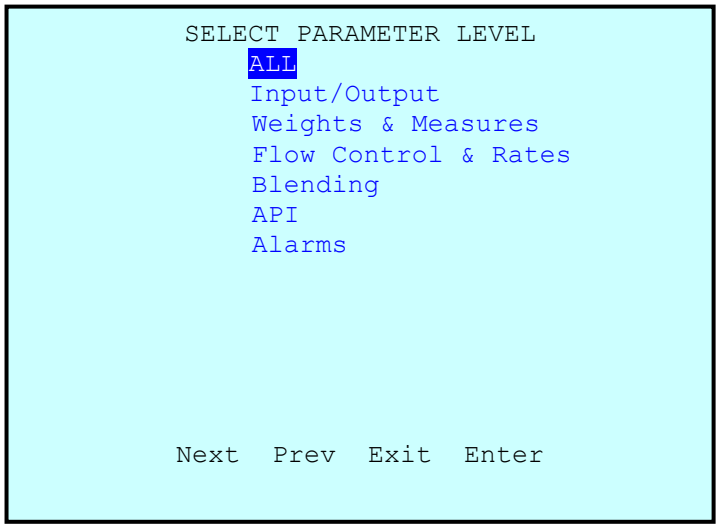
Parameter	Description
Load Screen Timeout	This parameter will return the user to the Load Screen after a period specified by this parameter. Specify the time in seconds. The Load Screen is the primary screen that displays all load arms or presets. To assist troubleshooting efforts, this feature is automatically disabled while the Program Key is activated.
Preset Slct Timeout	Preset Select Timeout. This parameter determines how long the highlight bar on the Group screen will stay active. The black highlight bar indicates which load arm or preset on the Group screen is selected. If this parameter is set to zero, the highlight bar will always be present over one of the load arm selections. If it is set to some time period, specified in seconds, the bar will disappear after the time has expired.
Pixel Test	Enable this parameter if it is mandatory to perform a display test before each transaction. When the test begins, each pixel is turned black for 0.75 seconds. Then, each pixel is blanked for 0.75 seconds. Inoperable pixels will appear as tiny, contrasting dots. When the test ends, the Load Screen is displayed.
Meter Proving Mode	When enabled, Meter Proving mode will be entered if in stand alone mode delivering a single product. Changes to W&M parameters will not be allowed unless the W&M switch is active.
Trace Preset Number	The Trace parameters are used to capture additional data from the system. Additional data will be sent to the event log, while this feature is active. This parameter must have a value specified to make use of the Trace parameters that follow. Enter a value that represents the Preset under test. Valid entry is 1. **This parameter is used for advanced troubleshooting. Do not enable without direction from Toptech Systems.**
Trace UAP Level	The Trace parameters are used to capture additional data from the system. Additional data will be sent to the event log, while this feature is active. This parameter must have a value specified to make use of the Trace parameters that follow. Enter a value that represents the level of trace for UAP. Valid entry is 1 to 5. **This parameter is used for advanced troubleshooting. Do not enable without direction from Toptech Systems.**
Trace Recipe	Use this parameter to view how blends are constructed in MultiLoad II. Blend composition used during deliveries of the preset specified in Trace Preset Number will be echoed to the event log for analysis. **This parameter is used for advanced troubleshooting. Do not enable without direction from Toptech Systems**.
Trace Adtv Number	Use this parameter to specify the injector under test. Only one injector can be put in trace at a time. First specify the injector's preset in Trace Preset Number. Then enter a value that represents the injector under test. Also, enable parameter Trace Adtv Volume. **This parameter is used for advanced troubleshooting. Do not enable without direction from Toptech Systems.**
Trace FCM Number	Use this parameter to specify an FCM for analysis. See parameter Trace FCM Assignment. Return this parameter to default value of 32 when not in use. **This parameter is used for advanced troubleshooting. Do not enable without direction from Toptech Systems.**
Trace FCM Assignment	When a value of 1 is entered in parameter field Trace FCM Number and when this parameter is enabled, the MultiLoad assignments will be echoed to the event log for analysis each time the MultiLoad II is rebooted. **This parameter is used for advanced troubleshooting. Do not enable without direction from Toptech Systems.**

Parameter	Description
Trace Meter Flows	Use this parameter to take samples of meter flow rates from the preset specified in Trace Preset Number. Flow meter rates are sampled every second. The flow rates are copied to the event log for analysis. The flow rates can them be exported to a spreadsheet and graphed for analysis. Data logged includes total volume delivered, meter flow rates, and digital valve states. **This parameter is used for advanced troubleshooting. Do not enable without direction from Toptech Systems.**
Trace Adtv Volume	When enabled, this parameter will copy the volumetric details of each injection to the event log for analysis. Use parameters Trace Preset Number and Trace Adtv Number to specify the injector under test. **This parameter is used for advanced troubleshooting. Do not enable without direction from Toptech Systems.**
Max Lines on a Ticket	This parameter is at the moment only used in UAP mode. It defines the number of lines on each printed ticket.
W&M Key FCM #	Allows connection of an external switch to gain write access to W&M parameters. Set this parameter to the FCM and Port for the input where the switch is attached. The input value at this location will be ORd with the MultiLoad II W&M switch status. RCU Diagnostic will show that status of this switch.
Program Key FCM #	Allows connection of an external switch to gain write access to program mode. Set this parameter to the FCM and Port for the input where the switch is attached. The input value at this location will be Ord with the MultiLoad II program mode switch status. RCU diagnostics will show the status of this switch
Startup Keypad Locked	At startup of the Multiload2 the keypad is locked or not locked. The only screen where the keypad is still working is the IDLE Screen. So the Configuration Menu is always accessible.
Screen Brightness	Brightness of the Display
RCU Address	Enter MultiLoad II RCU address. Valid entries are 001-099. Toptech strongly recommends use of address 001 for all MultiLoad IIs.

4.6 EQUIPMENT SETUP

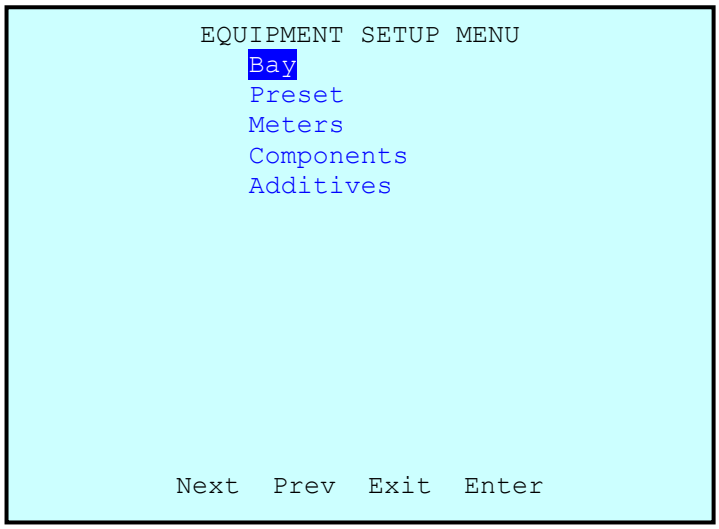
Use the Equipment Setup functions to configure the Bay and its associated presets, meters, components and additives.

Navigate to this screen as: Program Mode -> Configuration -> Equipment Setup -> Select Parameter Level



This new selection groups the parameters together, so each parameter can be easly found. It is possible that some parameters are under more than 1 group.

The Equipment Setup Menu will display:



Note: A typical MultiLoad II SMP bay would consist of one load arm or Preset, one main product Meter/control valve connected to one Component and may have up to two Additives:

The following table shows the relationships between internal I/O board ports and the functional assignments:

AC Output	Port 0	Additive Injection Output 1
AC Output	Port 1	Additive Injection Output 2
AC Output	Port 2	N.O. Solenoid

AC Output	Port 3	N.C. Solenoid
DC Input	Port 4	Meter Channel A
DC Input	Port 5	Meter Channel B (optional)
DC Input	Port 6	Additive Meter Input 2
DC Input	Port 7	Additive Meter Input 1
DC Input	Port 9	Ground input
DC Output	Port 10	
DC Output	Port 11	
DC Output	Port 12	

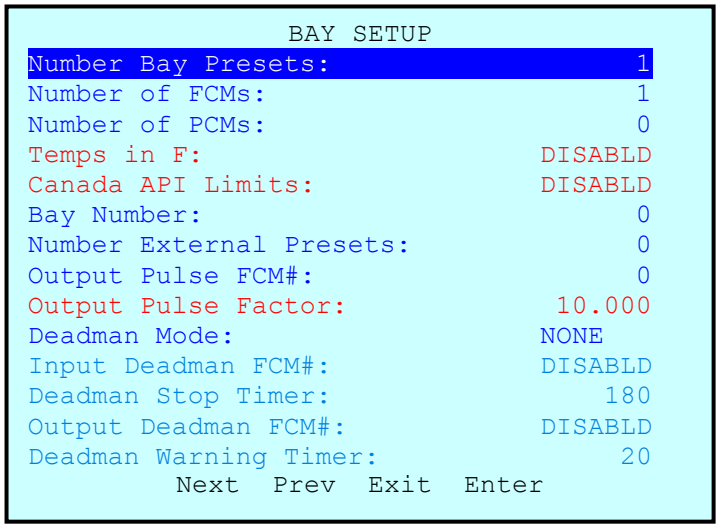
4.6.1 BAY SETUP

Use the Bay Setup functions to configure all Bay level configurations.

Navigate to this screen as: Program Mode -> Configuration -> Equipment Setup -> Select Parameter Level -> Bay Setup

All Weights and Measures controlled values are displayed in red both on the screen and in this manual.

The Bay Setup screen displays:



Parameter	Description
Number Bay Presets (Excluding SMP)	Enter the number of presets (load arms) that will be controlled by this MultiLoad II.
Number of FCMs	Enter the number of Flow Control Modules (FCM) including the I/O board that will be attached to this bay. The maximum number of FCMs that can be attached to a bay is 32 (1 on MultiLoad II SMP).
Number of PCMs	Enter the number of Printer Control Modules (PCM) that will be attached to this bay.
Temps in F	This selection indicates whether temperatures will be in Fahrenheit or Celsius. Select "Enabled" to choose Fahrenheit or "Disabled" to choose Celsius.
Canada API Limits	When enabled, API tables will use extended temperature ranges as required by Measurement Canada.
Bay Number	Enter a number that the terminal or depot uses to identify the bay (gantry). This bay designation will appear on Meter Tickets and Alibi Logs. Valid entries are 000-9999.
Number External Presets (Excluding SMP)	Enter the number of external presets a host system will display on the MultiLoad II load screen. These presets will be displayed with a green background color with a “Not Legal for Trade” message. See the MultiLoad II Communication Manual for more information.

Parameter	Description
Output Pulse FCM#	This parameter enables an output port that will provide an output pulse that is representative of the volume delivered. For FCMs and I/O boards with firmware 035 and earlier, the port setting must always be set to 1 for FCMs and 10 for I/O boards. For FCMs and I/O boards with firmware 036 and later, the port setting can be 0-5 for FCMs, and 10-12 for I/O boards. For FCMs and I/O boards with firmware 038 and later, support dual pulse outputs. Enable dual pulse output by configuring the “Invert” state on this port. This port will be the leading pulse, The trailing pulse will be the next contiguous port (0/1, 1/2, 2/3, 3/4, 4/5, 10/11, 11/12) on the FCM or I/O board. Notes: Single Output Pulse Limited to 500 Hz Max. Dual Output Pulse Limited to 250 Hz Max. Output pulses are NOT real time and delayed up to 1 second from acquisition.
Output Pulse Factor	A factor can be applied to the pulse output to achieve the desired pulse resolution. The pulse resolution can be configured from 0.001 to 50.000 pulses per unit of measure.
Deadman Mode	None: Deadman functionality is disabled ContHld: (Continiuos Hold) The Deadman input needs to be preset when the loading goes in low flow, if not the load will stop. No pre-alarm is given Hld&Rel: (Hold and Release) The Deadman input needs to be pushed continiuos , when the pre-alarm gets triggered the deadman needs to be released (for maximum of 3 seconds), after that needs to be pushed again until the pre-alarm goes of again. Push: (Push) The deadman needs to be pushed in intervals . The deadman needs to be pushed when the pre-alarm is active. Also a push earlier will reset the interval!
Input Deadman FCM#	This is the deadman reset button, to recalculate the interval
Deadman Stop Timer	The deadman interval when the load needs to be stopped, when the reset button was not handled in the correct mode.
Output Deadman FCM#	This is the deadman output for the pre-alarm, so the driver is notified if the deadman stop interval is almost expired.
Deadman Warning Timer	The time before the deadman stop timer is expiring and this will also trigger the pre deadman alarm output.
Deadman Bypass Key FCM#	Without going into the program mode it is possible to disable the deadman functionality with a key switch
Alarm Out FCM#	Provides an output signal when the bay has an active alarm. This parameter selects an output port that will be assigned to signal an unspecified alarm condition at the bay.
Authorized FCM#	Provides an output signal upon successful completion of the authorization process. The output will stay active until the transaction completes. This output is often used to signal the starting and stopping of vapor recovery units (VRU).
Permiss (0-7) FCM#	Allows the selection of a Flow Control Module (FCM) and port that will receive an input signal. The input signal will represent the state of Permissive 0-7. If the signal is not present at authorization or if the signal is lost during delivery, the process will be stopped and a bay level alarm will be raised.
Permiss Out FCM#	This parameter permits the selection of a Flow Control Module (FCM) and port that will provide an output signal. The signal will represent a loss of one or more of the bay permissives 0-7.

DEADMAN SETUP

Belows table will show what parameters needs to be configured for each mode.

Deadman mode	Input Deadman	Stop Timer	Output Deadman	Warning Timer
None				
ContHld	X			
Hld&Rel	X	X	X	X
Push	X	X	X	X

4.6.2 PRESET SETUP

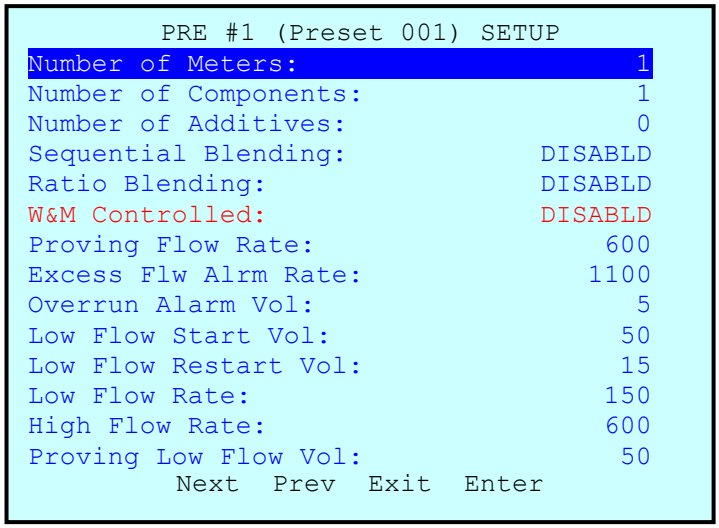
Use the Preset Setup functions to configure the characteristics of a load arm.

Further details about flow control can be found in Chapter 5.

Navigate to this screen as: Program Mode -> Configuration -> Equipment Setup -> Select Parameter Level -> Preset

All Weights and Measures controlled values are displayed in red both on the screen and in this manual.

The Preset Setup screen displays:


PRE #1 (Preset 001) SETUP
Number of Meters: 1
Number of Components: 1
Number of Additives: 0
Sequential Blending: DISABLD
Ratio Blending: DISABLD
W&M Controlled: DISABLD
Proving Flow Rate: 600
Excess Flw Alrm Rate: 1100
Overrun Alarm Vol: 5
Low Flow Start Vol: 50
Low Flow Restart Vol: 15
Low Flow Rate: 150
High Flow Rate: 600
Proving Low Flow Vol: 50
Next Prev Exit Enter

Parameter	Description
Number of Meters (Excluding SMP)	Enter the number of flow meters that will be assigned to the load arm (preset).
Number of Components	Indicates the number of components that will flow through the meter.
Number of Additives	Indicates the number of additives that will be assigned to the load arm. A maximum of 2 additives can be assigned. The minimum number is 0 additives.
Sequential Blending (Excluding SMP)	Enables Sequential Blending. Enable this parameter if using one flow meter in the preset, with multiple components. For single component loading through a single flow meter, this parameter can be disabled.
Ratio Blending (Excluding SMP)	Enables Ratio Blending. Multiple flow meters and control valves are required for ratio blending. Enable this parameter if multiple flow meters and control valves are assigned to the load arm and Ratio Blending is desired.
W&M Controlled	Enables select blending and recipe parameters for this preset to be under W&M control.
Proving Flow Rate	Enter the target flow rate that will be used during the proving run.
Excess Flw Alrm Rate	This parameter defines the flow rate that will trigger the Excess Flow Rate Alarm. A flow rate is considered excessive if it exceeds the absolute maximum rate that the load arm is rated for. The value of this parameter should be higher than the High Flow Rate parameter in the Preset Menu.
Overrun Alarm Vol	Defines the volume of overrun that will trigger the Overrun Volume Alarm. The overrun volume is the volume of product delivered that exceeds the preset quantity.

Parameter	Description
Low Flow Start Vol.	After the initial start of a batch, the flow rate will be maintained at the Low Flow Start target flow rate until the Low Flow Start Volume has been delivered.
Low Flow Restart Vol.	When restarting an interrupted batch, the flow rate will be maintained at the Low Flow Start flow rate until the Low Flow Restart volume has been delivered.
Low Flow Rate	This rate specifies the Low Flow target flow rate. This rate will be maintained until the Low Flow Start Volume has been delivered. This rate will also be used for the Low Flow Restart stage.
High Flow Rate	This parameter specifies the High Flow target flow rate. Maximum flow through the load arm is determined by this rate. This rate will be maintained until the 1st Stage Trip Volume has been reached.
Proving Low Flow Vol	During the proving process, delivery into a proving vessel will begin at a Low Flow Rate, until the value specified by this parameter has been delivered. Enter a value that will determine how much volume will be delivered at the Low Flow Rate. Typically the required Low Flow Start Volume for a proving delivery is less than the Low Flow Start Volume of a normal delivery.
Line Flush Vol (Excluding SMP)	Specify the volume of product required to flush the pipe segment that lies between the flow meter and the end of the load arm. When this parameter is set to zero, the Line Flush feature is disabled.
Line Flush Min Vol (Excluding SMP)	Specify the volume of line flush that will be acceptable if the actual Line Flush Volume is not reached. If the Line Flush Minimum Volume fails to be delivered, the line flush alarm will activate. This parameter is intended to prevent nuisance alarms due to small, acceptable deviations from the Line Flush Volume. The Minimum Line Flush Volume will be the Flush value displayed on the status screen and that value will decrement as the line is flushed.
Line Flush Comp# (Excluding SMP)	Select the component to be used to flush the pipe segment that lies between the flow meter and the end of the load arm. After the Line Flush Component is metered, it will remain in the line segment beyond the flow meter when the preset quantity has been reached and the load has been completed. The Flush Component will not be delivered during the load in which it was metered, but it will be delivered in a subsequent load. In effect, the Flush Component is the first product into the truck, but it is not metered as part of the load until the Line Flush phase of delivery. The range of entries is 1 for component #1 to a number that represents the highest order component configured for the preset.
Take L.F. from Match (Excluding SMP)	Take Line Flush From Matching component. If one of the components used in a given recipe happens to be the designated Line Flush Component, this recipe component will be under delivered to accommodate the Line Flush Volume at the end of the load. The under delivered portion will be delivered during the Line Flush phase. Choices for this parameter are Disable or Enable. If this parameter is disabled, the recipe will choose to short either the first recipe component or the last recipe component as specified by the two parameters that follow.
Take L.F. from First (Excluding SMP)	Take Line Flush From First recipe component. If the Take Line Flush From Match parameter is disabled or if the designated flush component is not used in a particular recipe, the algorithm will look to this parameter for instruction on which recipe component to short. A recipe component must be shorted to accommodate the Line Flush Volume. If this parameter is set to enable, the first recipe component will be chosen as the component to be shorted. If this parameter is disabled, the algorithm will look to the next parameter for instruction: Take L.F. From Last.

Parameter	Description
Take L.F. from Last (Excluding SMP)	Take Line Flush From Last component. If the Take Line Flush from Match parameter is disabled or if the designated flush component is not used in a particular recipe and if the Take L.F. From First parameter is disabled, the algorithm will look to this parameter for instruction on which recipe component to short. A recipe component must be shorted to accommodate the Line Flush Volume. If this parameter is set to enable, the last component assigned to the recipe will be chosen as the component to be shorted. This parameter cannot be disabled if the previous two parameters are both disabled.
Compute Blend Density	When meter level density is not defined and component level density is defined, if Compute Blend Density is enabled, the meter density is computed by a volume weighted average of the component densities. If Compute Blend Density is not enabled, then meter density is taken from the main component density.
Alt. High Flow Rate	Alternative High Flow Rate is intended to be an intermediate flow rate that is employed when liquid in the air eliminator tank has fallen to a certain level, requiring a flow rate less than the High Flow Rate but greater than the Low Flow Rate. Set this parameter to a value less than the High Flow Rate but equal to or greater than the Low Flow Rate parameter.
Stop Start Delay	This parameter is to ensure that a certain minimum amount of time (in seconds) lapses between the stopping and starting of flow. Powering up the MultiLoad and exiting program mode will also start this delay timer. If starting flow is attempted inside this delay period by the driver, the MultiLoad will log a message indicating that a driver attempted to start flow inside this delay. The Preset state will stay in the "Starting" state until the delay period lapses, then flow will start as normal.
Blend Chk Start Vol (Excluding SMP)	Blend Check Start Volume applies to ratio blending only. After the volume specified in this parameter has been delivered, the system will start checking the ratio of the blend. This parameter is intended to give the flows from the multiple meters an opportunity to stabilize after an initial start from zero flow. No blend ratio checks or adjustments are made until after this volume has been delivered. This setting should be configured to be greater than the Low Flow Start Volume, so that checks can begin after the transition to High Flow.
Blnd Chk Restart Vol (Excluding SMP)	Blend Check Restart Volume applies to ratio blending only. After the volume specified in this parameter has been delivered, the system will start checking the ratio of the blend. This parameter is intended to give the flows from the multiple meters an opportunity to stabilize after a restart from zero flow. Blend ratio checks will not resume until after this volume has been delivered. This setting should be configured to be greater than the Low Flow Restart Volume, so that checks can begin after the transition to High Flow.
Blnd Chk Alarm % (Excluding SMP)	Ratio Blending-Blend Check Alarm %. When the ratio is found to be out of tolerance by the percentage specified in this parameter, loading will stop and an OVR BLEND or UND BLEND alarm will be raised. The alarm will occur when the percentage error has lasted for the period specified by the Blend Check Alarm Time parameter. Sequential Blending-In sequential blending applications, this parameter can be used to raise an alarm when the blend composition is out of specification at batch completion. If, upon completing delivery and clearing the totals, the ratio of any component of a sequential blend is out of specification by the value entered in this parameter, an OVR BLEND or UND BLEND alarm will be raised.

Parameter	Description
Blnd Chk Alarm Vol (Excluding SMP)	Ratio Blending-Blend Check Alarm Volume. When the ratio is found to be out of tolerance by the volume specified in this parameter, loading will stop and an OVR BLEND or UND BLEND alarm will be raised. The alarm will occur when the volume error has lasted for the period specified by the Blend Check Alarm Time parameter. Sequential Blending-In sequential blending applications, this parameter can be used to raise an alarm when the blend composition is out of specification at batch completion. If, upon completing delivery and clearing the totals, the volume of any component of a sequential blend is out of specification by the value entered in this parameter, an OVR BLEND or UND BLEND alarm will be raised.
Blnd Chk Alarm Time (Excluding SMP)	Blend Check Alarm Time applies to ratio blending only. When the ratio is found to be out of tolerance for the time period determined by this parameter, loading will stop and a blend ratio alarm will occur. Enter time in seconds.
Low Flow Start Percentage	Calculate from the entered preset amount the low flow start volume. This volume will be only used when it is larger than the Low Flow Start parameter.. This calculated volume will not exceed 65,535. The low flow restart value will not be calculated using the preset value..
Blnd On Lead Comp. (Excluding SMP)	Blend on Lead Component applies to ratio blending and side-stream blending only. Enable this parameter to have all other components track the flow rate of the lead component. The lead component is defined as the first component listed in the product recipe. The product recipe is provided to MultiLoad by Terminal Automation Systems (TAS), such as TMS5/6. This feature should be used when blending viscous components, such as asphalt. The lead component should be the component that is expected to be the limiting factor in achieving maximum flow for the blend. The lead component can be limited by inconsistent pump pressure, for example. (v2.25) The leading component can be defined on three ways: FIRCOMP: First component defined in the recipe HIGPERC: The highest percentage of the components defined in the recipe LOWPERC: The lowest percentage of the components defined in the recipe
Blnd Adj Start Vol (Excluding SMP)	Blend Adjust Start Volume applies to ratio blending only. After the volume specified in this parameter has been delivered, the system will start adjusting the ratio of the blend, when it is found to deviate from the tolerance by the amount specified in the Blend Adjust Deviation Percentage parameter. The deviation must occur for the period specified by the Blend Adjust Time parameter before any adjustments are attempted. This parameter is intended to give the flows from the multiple meters an opportunity to stabilize after an initial start from zero flow. No blend ratio adjustments are made until after this volume has been delivered. This setting should be configured to be greater than the Low Flow Start Volume and less than the Blend Check Start Volume, so that adjustments can begin after the transition to High Flow.
Blnd Adj Restart Vol (Excluding SMP)	Blend Adjust Restart Volume applies to ratio blending only. After the volume specified in this parameter has been delivered, the system will begin adjusting the ratio of the blend, when it is found to deviate from the tolerance by the amount specified in the Blend Adjust Deviation Percentage parameter. The deviation must occur for the period specified by the Blend Adjust Time parameter before any adjustments are attempted. This parameter is intended to give the flows from the multiple meters an opportunity to stabilize after a Restart from zero flow. No blend ratio adjustments are made until this volume has been delivered. This setting should be configured to be greater than the Low Flow Restart Volume and less than the Blend Check Restart Volume, so that adjustments can begin after the transition to High Flow.

Parameter	Description
Blnd Adj Dev % (Excluding SMP)	Blend Adjust Deviation Percentage applies to ratio blending only. The system will begin adjusting the ratio of the blend when it is found to deviate from the tolerance by the amount specified in this parameter. The deviation must occur for the period specified by the Blend Adjust Time parameter before any adjustments will be attempted.
Blnd Adj Dev Vol (Excluding SMP)	Blend Adjust Deviation Volume applies to ratio blending only. The system will begin adjusting the ratio of the blend, when it is found to deviate from the specified tolerance by the volume entered in this parameter. The deviation must occur for the period specified by the Blend Adjust Time parameter before any adjustments will be attempted.
Blnd Adj Time (Excluding SMP)	Time period, in seconds, during which a deviation in the blend ratio tolerance must occur in order for a ratio adjustment to be made. (See parameters Blnd Adj Dev% and Blnd Adj Restart Vol.)
Proving Low Flow Rate	The low flow rate which will be used during the proving mode
Min Preset Volume	Minimum preset volume allowed.
Default Preset Volume	When non-zero and operating in stand-along mode, this value will be the default preset volume to load. If there is only one authorized product, no prompting will occur.
Max Preset Volume	Maximum preset volume allowed.
Auto Batch Authorize	When enabled, if operating in stand-alone mode, a transaction is authorized, and the program mode switch is inactive, the system will attempt to auto authorize the batch. If only one product is authorized to be loaded on this arm and the default preset volume is valid, no prompting will occur.
Deliver in Typ	This parameter, when NET is selected, will allow preset quantities to be entered as net volumes and delivered as net volumes. CTL and/or CPL must be configured before net delivery can be realized. Each preset in the bay can be configured independently of the others for gross or net delivery. When MASS is selected, will allow preset quantities to be entered as mass and delivered as mass. CTL and/or CPL must be configured before mass delivery can be realized. Each preset in the bay can be configured independently of the others for gross or net delivery. Also the RCU setting UOM for mass needs to be maintained otherwise an *IFVCONFIG alarm will be raised. If this parameter is selected on the GROSS delivery typ, preset entries will be in gross and delivery will be based on gross volumes.
BlkValve Open Delay	Set this parameter to delay the opening of a block valve by a period specified in seconds. When a preset-level block valve is employed, it will be commanded to open after the delay time has expired. The delay timer will commence at the moment that the Start button is pressed.
B.V. Open Alarm Time	Specifies a time in seconds to allow the preset-level block valve to open. If the valve employs a feedback signal, an alarm will occur if the feedback signal is not received within the specified time.
B.V. Close Alarm Time	Specifies a time in seconds to allow the preset-level block valve to close. If the valve employs a feedback signal, an alarm will occur if the feedback requirement is not satisfied within the specified time

Parameter	Description
Non-Proportional Blending	Non-proportional Blending is a type of blending which is used when a certain arm has blendings from 5 to 95 percent. Instead of keeping the load continues in spec the non-proportional blend will be out of spec the whole time until the full load is finished. Multiload will pre-calculate the target for all components. This is working for ratio as side-stream blends. The flow of the products: Multiload will check in the recipe which is the biggest component. The biggest component will run alone in Low Flow , when the main component goes in High Flow the other small components are also starting in High Flow. The High Flow rate for each component is defined on the Component Level.(Component High Flow rate) This rate should be near max flow rate of the meter. So this means that in Low Flow that pre-defined Preset Low Fow is used for the main component. For the High Flow the Multiload will look only for each component to the high flow rate of the component **and NOT to the Preset High Flow parameter**! This type of blending will have a high accuracy , because the meters of the smaller component will run almost on max flow rate and around the min flow rate of the meter which has a less accuracy. The pre-defined first trip and second trip are still used as it was before. Most common the first and second trip volume for the low grade products are set to zero.
Output Pulse FCM#	This parameter enables an output pulse that is representative of the volume delivered through a preset's flow meter. For FCMs and I/O boards with firmware 035 and earlier, the port setting must always be set to 1 for FCMs and 10 for I/O boards. For FCMs and I/O boards with firmware 026 and later, the port setting can be 0-5 for FCMs, and 10-12 for I/O boards. For FCMs and I/O boards with firmware 038 and later, support dual pulse outputs. Enable dual pulse output by configuring the “Invert” state on this port. This port will be the leading pulse. The trailing pulse will be the next contiguous port (0/1, 1/2, 2/3, 3/4, 4/5, 10/11, 11/12) on the FCM or I/O board. Notes: Single Output Pulse Limited to 500 Hz Max. Dual Output Pulse Limited to 250 Hz Max. Output pulses are NOT real time and delayed up to 1 second from acquisition.
Output Pulse Factor	A factor can be applied to the pulse output to achieve the desired pulse resolution. The pulse resolution can be configured from 0.001 to 50.000 pulses per unit volume or mass.
Output Pulse Typ	When NET, output pulses will represent net volumes. CTL and/or CPL must be configured before pulses representing net volume can be realized. The output pulses will represent gross volumes when this parameter is set to GROSS. When the parameter is set to MASS , output will be Mass. It is necessary that density as UOM typ of Mass are populated.
Alt. High Flow Start Delay	Set this parameter to delay the entering of the Alt. High Flow Rate. The Alt. High Flow Rate Signal must be active for the entire time, otherwise the timer restarts. This parameter is typically used with bubble detectors.

Parameter	Description
Alt. High Flow Stop Delay	Set this parameter to delay the exiting of the Alt. High Flow Rate. The Alt. High Flow Rate Signal must be not active for the entire time, otherwise the timer restarts. This parameter is typically used with bubble detectors.
Permissive Alarm Time	Set this parameter to delay the raising of a permissive alarm. The permissive must be not active for the entire time, otherwise the timer restarts. This parameter is typically used with bubble detectors.
Remote Clear FCM#	Permits selection of a Flow Control Module (FCM) and port that will allow a remote switch to clear a completed batch. This option used with the Remote Start and Auto Batch Authorize parameter may be very useful for barrel filling or other multi-batch operation.
Alt. HF Rate FCM# (Excluding SMP)	Permits selection of a Flow Control Module (FCM) and port that will monitor an input from an air eliminator head or other device. When an input is received, Flow will change from the High Flow Rate to an alternative flow rate specified by the Alt. Flow Rate parameter found in Preset Weights & Measures.
Close Blk Val FCM#	Permits selection of an output port that will provide an output signal to close a preset-level block valve. This feature is provided for block valves that require separate opening and closing signals.
Blk Val Status FCM#	Block Valve Status FCM# parameter allows the selection of a port that will receive an input signal. The input signal will represent the state of the preset-level block valve, indicating whether it is open or closed. When the block valve is closed, an external contact attached to the valve will close, applying a status signal to the input. When the block valve is open, the external contact will also be open, removing the status signal from the input. When the block valve has been commanded to open, the absence of a signal at the input will indicate that the valve has opened. If the "closed" signal is still present after the Block Valve Open Delay time has elapsed, a block valve failure alarm will be issued. When the block valve has been commanded to close, the presence of the status signal at the input will indicate that the valve has closed. If the "closed" signal has not been detected by the time the Block Valve Close Delay time has elapsed, a block valve failure alarm will be issued.
Open Blk Val FCM#	Permits selection of a port that will provide an output signal to open a preset-level block valve. The preset-level block valve is commanded to open after the Start button has been pressed and the Block Valve Open Delay time has expired. The valve is commanded to close during any of the following conditions: batch completion, any alarm, when the Stop button is pressed or if the card is pulled from the card reader.
Flow Active FCM#	This parameter selects a port that will provide an output signal to indicate that flow is active. When the Start button is pressed, the signal will become active. The signal will de-activate upon batch completion, when the Stop button is pressed or when an alarm condition stops flow. The signal will re-activate, when the Start button is pressed following either an alarm condition or an intentional interruption of the batch. By default, a high signal will represent an active condition.
Batch Authorized FCM#	This parameter selects a port that will provide an output signal to indicate that the preset is authorized for loading. The signal will become active after authorization has been granted. The signal will stay active until the operator archives the batch by clearing the preset or by pulling the card. By default, a high signal will represent an active condition.

Parameter	Description
Remote Start FCM#	This parameter selects an input port that will be assigned to receive the input of a Remote Start button. The Remote Start Button can be used to start a load from a location away from the MultiLoad II, such as from a top loading position. The card-in process and preset entry must be completed at the MultiLoad II, prior to activating flow via the Remote Start Button. This feature can be used in conjunction with the Meter Stop function. If flow is stopped by a Meter Stop, flow can be restarted by actuating the Remote Start button. If flow is stopped due to a Low Flow Alarm, this alarm can be cleared and flow restartd by a single actuation of the Remote Start button.
Swing Arm FCM#	If a swing arm is configured for this preset, enter the Flow Control Module (FCM) and port number that will receive the Presets swing arm detector switch.
Meter Stop FCM#	Selects the input port that will be assigned to detect the Meter Stop button. When the Meter Stop switch is activated, the flow control valve will be closed and the component pump will be stopped.
Alarm Out FCM#	Alarm Out provides an output signal if the preset has an active alarm. This parameter selects the output port that will be assigned to signal an unspecified alarm condition at the preset.
Authorized FCM#	Authorized FCM provides an output signal if the preset has been authorized for flow as a result of driver card-in or product selection.
Permiss FCM#	Permiss FCM# parameter allows the selection of a port that will receive an input signal. The input signal will represent the state of the preset's Permissive. If the signal is not present at authorization or if the signal is lost during delivery, the process will be stopped and a permissive level alarm will be raised.
Permiss Out FCM#	This parameter permits the selection of a port that will provide an output signal. The signal will represent the loss of the preset's permissive.

4.6.3 METER SETUP

Use the Meter Setup functions to configure the characteristics of a product meter.

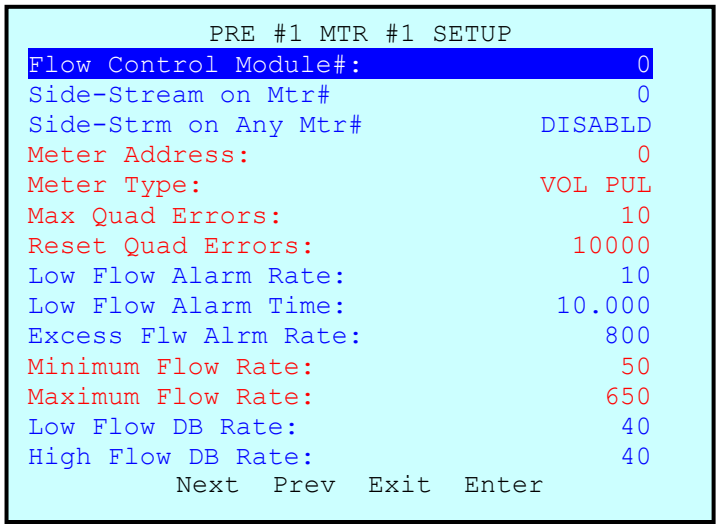
Further details about flow control can be found in Chapter 5.

Meter flow rates are configured in the Weights & Measures -> Meter section and can be found in Chapter 8.

Navigate to this screen as: Program Mode -> Configuration -> Equipment Setup -> Select Parameter Level -> Meter

All Weights and Measures controlled values are displayed in red both on the screen and in this manual.

The Meter Setup screen displays:


PRE #1 MTR #1 SETUP
Flow Control Module#: 0
Side-Stream on Mtr# 0
Side-Strm on Any Mtr# DISABLD
Meter Address: 0
Meter Type: VOL PUL
Max Quad Errors: 10
Reset Quad Errors: 10000
Low Flow Alarm Rate: 10
Low Flow Alarm Time: 10.000
Excess Flw Alrm Rate: 800
Minimum Flow Rate: 50
Maximum Flow Rate: 650
Low Flow DB Rate: 40
High Flow DB Rate: 40
Next Prev Exit Enter

Parameter	Description
Flow Control Module#	Assign a Flow Control Module (FCM) for the selected product flow meter. When using an internal I/O Board, 0 is the only valid entry. Port 4 will automatically be selected as the Channel A meter input signal. If a Channel B meter input is used, it must be connected to Port 5. To activate Channel B, see Weights and Measures parameter "Quad Check Enable." The digital control valve upstream and downstream outputs will automatically be assigned to Port 2 and Port 3 respectively.
Side-Stream on Mtr# (Excluding SMP)	If this meter will be a side-stream meter, use this parameter to identify the primary meter stream into which the side-stream meter will be flowing. See side-stream configuration section for more details.
Side-Stream on Any Meter (Excluding SMP)	Enable this parameter if a side-stream meter will be serving a load arm that has more than one custody-meter stream. A typical application is when one side-stream meter is used at a two-component ratio blending arm. The side-stream meter can only flow through one of the custody-meters at any given time, however.

Parameter	Description
Meter Type	This parameter identifies the type of meter input. Valid types are: VOL PUL = Volume Pulse Input (or Mass to Remain Mass) MAS PUL = Mass Pulse Input (to be converted to Volume) VOL ANALOG = Volume 4-20mA Analog Input VKrohne = Volume Input from Krohne Mass Meter Serial Input VMicroM = Volume Input from MicroMotion Mass Meter Serial Input **Volume Pulse Input** – Pulses from a meter indicate Volume. The Meter K-Factor and Meter Factors convert this pulse to a volume. **Mass Pulse Input** – This selction indicates that the pulse input is in Mass units, but should be converted to Volume. All displays and preset quantities will still be done in Volume. The MultiLoad II processes data and are configured at different equipment levels. Typically data flows from the actual meter hardware, into the Meter Level, then on to the assigned Component Level, and finally to the Preset Level. The incorporation of the "Mass Pulse" feature allows the Meter Level to flow product and process pulse data as mass. This includes weighting the observed temperature and density. Meter mass data is converted to volume when it is moved from the Meter Level into the Component Level (Vol = Mass / Density). In the Component Level gross volume is converted to net volume and both gross and net values are passed up to the Preset Level. While only the Meter Level actually processes mass data, most of the volume and rate parameters on the Component Level and Preset Level are passed down to the meter level to configure the flow control hardware (I/O board) for the load. When the "Pulse in Mass" feature is enabled, all of the volume and rate parameters listed in the Meter Level, Component Level, Preset Levels are in Mass units, EXCEPT THE FOLLOWING which remain in Volume units: Preset Level: Excess Flow Alarm Rate Preset Level: Overrun Alarm Volume Preset Level: Line Flush Volume Preset Level: Line Flush Min Volume Preset Level: Min Preset Volume Preset Level: Max Preset Volume Preset Level: Output Pulse Factor. Component Level: Unauthorized Flow Alarm Volume. Component Level: Block Valve Open Rate Component Level: Fallback Retry Volume **Volume 4-20mA Analog Input** – a 4-20mA signal indicates the flow rate. Using the Meter K-Factor, this signal is converted to a virtual pulse stream. The flow rate at 4mA and 20mA can be configured as well as a fine offset and lower cut off rate. The meter factors can be applied to calibrate the volume. **Note: FCM or I/O Board Firmware Version 039 or greater is required to use meter type Volume 4-20mA Analog Input.** **Volume Krohne Input** – a Modbus serial connection to the Krohne Mass Meter indicates the volume, volume flow rate, temperature and density values. Additional setup and diagnostic screens are available when this option is enabled. **Volume MicroMotion Input** – a Modbus serial connection to the MicroMotion Mass Meter indicates the volume, volume flow rate, temperature and density values. Additional setup and diagnostic screens are available when this option is enabled.

Parameter	Description
Max Quad Errors	This parameter is only valid when the Quadrature feature has been enabled. Enter the number of Quadrature (Pulse Security) errors that will trigger a Quadrature alarm. The alarm will stop flow. A dual Pick-Off flow meter or dual channel meter pulser is required to use this feature.
Reset Quad Errors	This parameter is only valid when the Quadrature feature has been enabled. This parameter establishes the number of pulses that will be checked for errors. If no Quadrature (Pulse Security) errors have occurred during the transmission of the number of pulses established by this parameter, the Quadrature error counter will reset itself. The error counter then will begin tabulating errors from zero. When the number of errors tabulated in the error counter exceeds the Max Quad Errors value before the quantity of pulses established in this parameter have been transmitted, a Quadrature alarm will occur.
Low Flow Alarm Rate	Specifies the absolute minimum flow rate of the flow meter. When the flow rate falls below this value for a period specified by the Low Flow Alarm Time parameter, the meter low flow alarm will activate. Typically, this value is set to the flow meter's lowest flow rate as published by the meter's manufacturer.
Low Flow Alarm Time	When the flow rate falls below the Low Flow Alarm Rate for the duration of time specified in this parameter, the Low Flow Rate Alarm will activate.
Excess Flw Alarm Rate	Specifies the absolute maximum flow rate of the flow meter. When the flow rate exceeds this value, the meter excess flow alarm will activate. Typically, this value is set to the flow meter's highest flow rate as published by the meter's manufacturer.
Minimum Flow Rate	Enter the minimum flow rate of the flow meter, as prescribed by the meter's manufacturer. The system will not command the flow rate to go below this value.
Maximum Flow Rate	Enter the maximum flow rate of the flow meter, as prescribed by the meter's manufacturer. The system will not command the flow rate to go above this value.
Low Flow DB Rate	The Low Flow Dead Band Rate specifies the amount of rate error that will be tolerated before a rate adjustment is attempted by the flow control valve. If, for example, this parameter is set to 10 gpm and the Low Flow Rate is set to 100 gpm, the valve will not attempt to adjust flow until the Low Flow Rate exceeds 110 gpm or until the Low Flow Rate falls below 90 gpm.
High Flow DB Rate	The High Flow Dead Band Rate specifies the amount of rate error that will be tolerated before a rate adjustment is attempted by the flow control valve. If, for example, this parameter is set to 10 gpm and the High Flow Rate is set to 1000 gpm, the valve will not attempt to adjust flow until the High Flow Rate exceeds 1010 gpm or until the High Flow Rate falls below 990 gpm.
1st Stage DB Rate	The First Trip Dead Band Rate specifies the amount of rate error that will be tolerated before a rate adjustment is attempted by the flow control valve. If, for example, this parameter is set to 10 gpm and the First Trip Flow Rate is set to 200 gpm, the valve will not attempt to adjust flow until the First Trip Flow Rate exceeds 210 gpm or until the First Trip Flow Rate falls below 190 gpm.
2nd Stage DB Rate	The Second Trip Dead Band Rate specifies the amount of rate error that will be tolerated before a rate adjustment is attempted by the flow control valve. If, for example, this parameter is set to 10 gpm and the Second Trip Flow Rate is set to 50 gpm, the valve will not attempt to adjust flow until the Second Trip Flow Rate exceeds 60 gpm or until the First Trip Flow Rate falls below 40 gpm.
Valve Cntl Alrm Time	When the control valve is unable to reduce flow within the period specified in this parameter, the Valve Control Alarm will activate. This alarm will stop the load. The repeated occurrence of this alarm may indicate that valve operation is sluggish; valve maintenance or inspection may be required.

Parameter	Description
Valve Fault Alrm Vol	When the valve has been commanded to close, the Valve Fault Alarm will activate if the valve fails to close before the Valve Fault Alarm Volume is delivered.
Creep Reset Time	Meter Creep is any volume that passes the meter when the valve is commanded to be shut. Creep volumes can occur when the component is authorized or unauthorized. This parameter will permit the internal creep counter to be reset periodically in order to avoid nuisance alarms, due to line shock. Resetting this internal counter periodically will prevent small amounts of meter creep from accumulating in the counter over time and triggering misleading Valve Fault alarms. Set the time in seconds. This function does not reset the Creep Totalizer that can be viewed in the Meter Views & Inquiry's screen.
Ratio Adj P. Factor (Excluding SMP)	Ratio Adjusted Proportional Factor. This parameter only applies to ratio blending. Do not adjust this parameter without consulting Toptech Technical Support.
Ratio Adj D. Factor (Excluding SMP)	Ratio Adjusted Derivative Factor. This parameter only applies to ratio blending. Do not adjust this parameter without consulting Toptech technical support.
Meter Creep Alrm Vol	Enter the volume of meter creep that will trigger a Meter Creep alarm. If the volume of meter creep specified in this parameter accumulates within the time period indicated in the Creep Reset Time parameter, a Meter Creep alarm will occur. Meter creep may indicate that there is a small leak in the valve or it may be the result of excessive line shock. Meter creep means that fluid is moving past the meter when the valve is supposed to be closed.
Flow Scan Time	Use this parameter to achieve smoother flow control if the flow meter's pulse resolution is low. The default scan time should be used if flow meter resolution is 40 pulses per gallon or greater. At the default setting of 0.100 seconds, the FCM will sample the flow rate 10 times every second. If the guidelines below do not produce the desired effect, increase the parameter value in increments of 0.100 seconds until the desired results are achieved. The range of settings is 0.100 to 1.000 seconds. 40 ppg = 0.100 seconds 25 ppg = 0.200 seconds 10 ppg = 0.500 seconds 1 ppg = 1.000 seconds
Valve Dwell Time	Use this parameter for digital control valves that have their opening and closing speed-adjust valves set wide open. This parameter should be adjusted when ball-style valves are used on digital control valves for opening and closing speed control. If the control valve contains needle style speed-adjust valves and they will be used to tune the control valve's opening and closing speeds, use the default setting of 1 second. Otherwise, use the following guidelines, based on valve size: 4" Digital Control Valve = 0.040- 0.080 seconds 3" Digital Control Valve = 0.030- 0.070 seconds 2" Digital Control Valve = 0.020- 0.040 seconds When the FCM attempts to adjust flow, the control valve's opening and closing solenoids are actuated. The Valve Dwell Time will determine the duration of solenoid actuation. As the Valve Dwell Time is reduced, the solenoid actuations will become increasingly short and rapid. As the valve opens or closes, it will take finer steps toward the target flow rate, as the Valve Dwell Time is reduced. See Valve Dwell Step Rate.
Valve Dwell Step Rate	This parameter is to be used in conjunction with Valve Dwell Time. Set this parameter to be four times the deadband rate. Large, course valve adjustments will be made when the flow rate is far from the deadband. As the deadband is approached, the valve will begin making the fine adjustments prescribed by Valve Dwell Time. The Deadband Rate setting can be found under Configuration/Equipment Setup/Meter. See Valve Dwell Step Time.

Parameter	Description
Valve Dwell Step Time	Set this value to 1.00 when using the Valve Dwell Time and Valve Dwell Step Rate parameters.
Adaptive Valve Control	When enabled, the Control Valve algorithm will attempt to adapt to the speed of the valve resulting obtaining more accurate target flow rates. To use this feature: Flow Scan Time must be set to 0.200 seconds. Valve Dwell Time set to 0.030 seconds.
Analog Valve Control	Enable this parameter to use a 4-20mA Analog Control Valve. 4mA is considered full closed, and 20mA is considered full open. 0mA indicates no flow, or inactive.
4-20mA Increase Step	The mA amount to INCREASE the analog output after each flow scan if the flow rate is found to be BELOW then the target dead-band flow rate.
4-20mA Decrease Step	The mA amount to DECREASE the analog output after each flow scan if the flow rate is found to be ABOVE then the target dead-band flow rate.
Analog Flow Rate @ 4mA	Enter the flow rate that is represented by a 4mA signal from the analog meter transmitter. This value is usually 0. Check the analog meter documentation or configuration for this value.
Analog Flow Rate @ 20mA	Enter the flow rate that is represented by a 20mA signal from the analog meter transmitter. This value is usually the maximum flow rate the meter can measure. Check the analog meter documentation or configuration for this value.
Analog Flow Rate Offset	Enter any needed flow rate offset. Any needed flow rate calibration adjustments should be made in the meter transmitter. Use this parameter to make adjustments if the flow rate on the meter is different than displayed on the MultiLoad.
Analog Flow Rate Cut-Off	Enter the Cut-Off flow rate. Any flow rate measured on the 4-20mA signal that is below this value will be processed as a zero flow rate.
Density Sensor	This parameter indicates the use of a density sensor for the selected meter. Enable this parameter if a density sensor is used to monitor density at the flow meter.
Density Sensor FCM#	Enter the FCM # for the density sensor. Enter a value of 0 for the internal I/O board.
Default Density	For API tables that require the entry of density, enter that value here. The value should be the density of the component at 15 ° C. The units are kg/m3. When the density sensor is disabled, this value will specify the density to be used for the meter level density. If the density sensor is disabled and this default density value is zero, the currently assigned component density will be used. If this meter is the main stream of a side stream blend, a volume weighted blend density will be calculated from the main and side stream component densities. For API tables that require a density, the meter level density will be used for this calculation.
Alarm Low Density	When a Density Sensor is enabled, this parameter can be used to raise an alarm when the measured density falls below a minimum value. When the density of the metered product falls below the value entered in this field, a DENSITY alarm will be raised and loading will be stopped. See Density Calibration for instructions on configuring a density sensor.
Alarm High Density	When a Density Sensor is enabled, this parameter can be used to raise an alarm when the measured density rises above a maximum value. When the density of the metered product exceeds the value entered in this field, a DENSITY alarm will be raised and loading will be stopped. See Density Calibration for instructions on configuring a density sensor.

Parameter	Description
Density Alarm Time	At the default value of zero seconds, density alarms will be raised instantly. A small delay can be added, in seconds, to avoid nuisance alarms that may occur when density is momentarily out of range. The density alarm timer will only run when a density alarm is not active and a batch is currently authorized on this preset.
Density @ 4mA	Enter the density that will represent the lowest density value measured by the transmitter. This value will be equal to 4 mA.
Density @ 20mA	Enter the density that will represent the highest density value measured by the transmitter. This value will be equal to 20 mA.
Density Offset	This parameter provides a means to introduce a density offset to correct the indicated density to the observed density.
Pressure Sensor	This parameter indicates the use of a pressure sensor for the selected meter. Enable this parameter if a pressure sensor is used to monitor pressure at the flow meter.
Pressure Sensor FCM#	Enter the FCM # for the pressure sensor. Enter a value of 0 for the internal I/O board.
Default Pressure	This is the pressure that the API table will use when the pressure transmitter is undergoing maintenance. Do not adjust this value unless the pressure transmitter is out of service. Return the value to 999.9 when the transmitter has been placed back into service.
Alarm Low Pressure	Enter the pressure that represents the lower pressure limit of the API table in use. When pressure falls below this value, an alarm will be raised.
Alarm High Pressure	Enter the pressure that represents the upper pressure limit of the API table in use. When pressure exceeds this value, an alarm will be raised.
Pressure Alarm Time	At the default value of zero seconds, pressure alarms will be raised instantly. A small delay can be added, in seconds, to avoid nuisance alarms that may occur when pressure is momentarily out of range.
Pressure @ 4mA	Enter the pressure that will represent the lowest pressure value measured by the transmitter. This value will be equal to 4 mA.
Pressure @ 20mA	Enter the pressure that will represent the highest pressure value measured by the transmitter. This value will be equal to 20 mA.
Pressure Offset	This parameter provides a means to introduce a pressure offset to correct the indicated pressure to the observed pressure. The offset range is -3.00 to 3.00 units.
Relative Density Sensor	This parameter indicates the use of a relative density sensor for the selected meter. Enable this parameter if a relative density sensor is used to monitor relative density at the flow meter.
Relative Density Sensor FCM#	Enter the FCM # for the relative density sensor. Enter a value of 0 for the internal I/O board.
Default Relative Density	For API tables that require the entry of relative density, enter that value here. The value should be the relative density of the component at 15 ° C. When the relative density sensor is disabled, this value will specify the relative density to be used for the meter level relative density. If the relative density sensor is disabled and this default relative density value is zero, the currently assigned component relative density will be used. If this meter is the main stream of a side stream blend, a volume weighted blend relative density will be calculated from the main and side stream component relative densities. For API tables that require a relative density, the meter level relative density will be used for this calculation.

Parameter	Description
Alarm Low Relative Density	When a Relative Density Sensor is enabled, this parameter can be used to raise an alarm when the measured relative density falls below a minimum value. When the relative density of the metered product falls below the value entered in this field, a DENSITY alarm will be raised and loading will be stopped. See Relative Density Calibration for instructions on configuring a relative density sensor.
Alarm High Relative Density	When a Density Sensor is enabled, this parameter can be used to raise an alarm when the measured density rises above a maximum value. When the relative density of the metered product exceeds the value entered in this field, a DENSITY alarm will be raised and loading will be stopped. See Relative Density Calibration for instructions on configuring a relative density sensor.
Relative Density Alarm Time	At the default value of zero seconds, density alarms will be raised instantly. A small delay can be added, in seconds, to avoid nuisance alarms that may occur when relative density is momentarily out of range. The relative density alarm timer will only run when a density alarm is not active and a batch is currently authorized on this preset.
Relative Density @ 4mA	Enter the relative density that will represent the lowest density value measured by the transmitter. This value will be equal to 4 mA.
Relative Density @ 20mA	Enter the relative density that will represent the highest density value measured by the transmitter. This value will be equal to 20 mA.
Relative Density Offset	This parameter provides a means to introduce a relative density offset to correct the indicated relative density to the observed relative density.
2% MF Limit Ref	The 2% Meter Factor Limit Reference is a number that is representative of the meter factors obtained during an initial proving session. Enter a value that is the average of all meter factors obtained during an initial proving session. Examples of initial proving sessions are provings that occur after a meter has been repaired or replaced. If, during subsequent proving sessions, any one of the four meter factors has changed from the reference by more than 2%, an INVCONFIG alarm will be raised. The flow meter should be inspected if it is not possible to obtain a meter factor that is within 2% of the reference. Set this parameter to zero to deactivate the feature.
Adjacent MF Dev Limt	Enter a value to limit variation in adjacent meter factors. The Adjacent Meter Factor Deviation Limit will prevent a meter factor adjustment that will result in a variation of the entered value. For example, it is desired to limit the variation of adjacent meter factors to 0.25%. If a new meter factor has been obtained for meter factor #2, this new meter factor cannot deviate more than plus or minus 0.25 percent from meter factor #1 or meter factor #3. If a new meter factor is entered that violates this setting, an INVCONFIG alarm will be raised after the MultiLoad II reboots. To set the limit to 0.25%, enter a value of 0.0025. The flow meter should be inspected if it is not possible to obtain a meter factor that does not violate this condition. Set this parameter to zero to deactivate the feature.
Temp Offset Limit	This parameter limits the range Temperature Offset that can be introduced. The valid range of entries is from one to five degrees. If a value of one is entered, for example, the Temperature Offset parameter can only be varied from zero by ± 1 degree. When measuring temperature in Celsius, enter a value of one. When measuring temperature in Fahrenheit, use a value of three.
Alarm Out FCM#	Alarm Out provides an output signal if the meter has an active alarm. This parameter selects the output port that will be assigned to signal an unspecified alarm condition from the meter.
Authorized FCM#	Authorized FCM provides an output signal if the meter has been authorized for flow as a result of driver card-in or product selection.

Parameter	Description
Permiss FCM#	Allows the selection of a port that will receive an input signal. The input signal will represent the state of the meter's permissive. If the signal is not present at authorization or if the signal is lost during delivery, the process will be stopped and a permissive meter level alarm will be raised.
Permiss Out FCM#	This parameter permits the selection of a Flow Control Module (FCM) and port that will provide an output signal. The signal will represent the loss of the meter's permissive.
Meter K-Factor	The K-factor represents the number of pulses produced per unit of volume delivered. The unit of volume represented in the K-factor will determine the unit of volume used in all parameters that require a volume specification.
Quad Check Enable	Quadrature Check, also known as Pulse Security, can be enabled or disabled with this parameter. This function is intended to provide verification of meter pulse inputs by receiving two meter pulse train inputs from a single flow meter. The quadrature input must use Port 5. The primary meter input must use port 4.
Temperature Offset	This parameter provides a means to introduce a temperature offset to correct the indicated temperature to correspond with the observed temperature. The offset range can be limited from 1-5 degrees via the parameter Temperature Offset Limit.
Temperature Alarm Time	At the default value of zero seconds, temperature alarms will be raised instantly. A small delay can be added, in seconds, to avoid nuisance alarms that may occur when a RTD module is synchronizing with its FCM after recovering from a power failure.
Temp Sensor FCM#	When the Temp Module type is +10, enter the FCM # for the temperature sensor. Enter a value of 0 for the internal I/O board.
Temperature Sensor	Enable this parameter to activate a temperature sensor for this meter. Disable this parameter if the temperature will be taken from a source outside of the SMP. See also parameters Temp Module Type and Temp Sensor FCM#.
Default Temperature	In the event of a RTD failure, the observed temperature can be entered manually for use by the system until the RTD is repaired. Upon failure of a RTD, a RTD alarm will occur. If it is necessary to take the RTD out of service, disable (turn off) the RTD Enable parameter and key in the observed temperature. When the RTD is brought back into service, enable the RTD Enable parameter.
Alarm Low Temp	When the temperature of the metered product falls below the temperature specified by this parameter, the Low Temperature alarm will activate. Enter the temperature in Celsius or Fahrenheit. The temperature units used for the entire bay are determined by a parameter in the Bay menu.
Alarm High Temp	When the temperature of the metered product rises above the temperature specified by this parameter, the High Temperature alarm will activate. Enter the temperature in Celsius or Fahrenheit. The temperature units used for the entire bay are determined by a parameter in the Bay menu.

Parameter	Description
Temp Module Type	Enter a value that represents the appropriate type of temperature sensor. For a typical setups, set to 1. For MultiLoad II SMP: 1 – Internal I/O Board RTD 3 – Internal I/O Board 4-20mA For MultiLoad II: 0 – External FCM with Opto22 RTD Module 1 – Internal I/O Board RTD or External FCM with Toptech RTD Module 2 – External FCM with Opto22 4-20mA Module 3 – Internal I/O Board 4-20mA Add +10 to this value to specify a FCM other then the FCM that the meter is assigned. Use Temp Sensor FCM# to specify the alternate FCM.
Temperature @ 4mA	When using a temperature sensor that provides a 4-20 mA signal, enter the temperature that is represented by 4 mA.
Temperature @ 20mA	When using a temperature sensor that provides a 4-20 mA signal, enter the temperature that is represented by 20 mA.
BSW Sensor	This parameter indicates the use of a bsw sensor for the selected meter. Enable this parameter if a bsw sensor is used to monitor bsw at the flow meter.
BSW Sensor FCM#	Enter the FCM # for the BSW sensor. Enter a value of 0 for the internal I/O board.
BSW Density	When the BSW sensor is disabled, this value will specify the BSW to be used for the meter level BSW. If the BSW sensor is disabled and this default BSW value is zero, the currently value will we always zero. No component level BSW.
Alarm Low BSW	When a BSW Sensor is enabled, this parameter can be used to raise an alarm when the measured BSW falls below a minimum value. When BSW of the metered product falls below the value entered in this field, a BSW alarm will be raised and loading will be stopped. See BSW Calibration for instructions on configuring a BSW sensor.
Alarm High BSW	When a BSW Sensor is enabled, this parameter can be used to raise an alarm when the measured BSW rises above a maximum value. When the BSW of the metered product exceeds the value entered in this field, a BSW alarm will be raised and loading will be stopped. See BSW Calibration for instructions on configuring a BSW sensor.
BSW Alarm Time	At the default value of zero seconds, BSW alarms will be raised instantly. A small delay can be added, in seconds, to avoid nuisance alarms that may occur when BSW is momentarily out of range. The BSW alarm timer will only run when a BSW alarm is not active and a batch is currently authorized on this preset.
BSW @ 4mA	Enter the BSW that will represent the lowest BSW value measured by the transmitter. This value will be equal to 4 mA.
BSW @ 20mA	Enter the BSW that will represent the highest BSW value measured by the transmitter. This value will be equal to 20 mA.
BSW Offset	This parameter provides a means to introduce a BSW offset to correct the indicated BSW to the observed BSW.
API Gravity Sensor	This parameter indicates the use of an API Gravity sensor for the selected meter. Enable this parameter if an API Gravity sensor is used to monitor API Gravity at the flow meter.
API Gravity Sensor FCM#	Enter the FCM # for the API Gravity sensor. Enter a value of 0 for the internal I/O board.

Parameter	Description
Default API Gravity	For API tables that require the entry of API Gravity, enter that value here. The value should be the API Gravity of the component at 15 ° C or 60 F. When the API Gravity sensor is disabled, this value will specify the API Gravity to be used for the meter level API Gravity. If the API Gravity sensor is disabled and this default API Gravity value is zero, the currently assigned component API Gravity will be used. If this meter is the main stream of a side stream blend, a volume weighted blend API Gravity will be calculated from the main and side stream component API Gravity. For API tables that require an API Gravity, the meter level API Gravity will be used for this calculation.
Alarm Low API Gravity	When an API Gravity Sensor is enabled, this parameter can be used to raise an alarm when the measured API Gravity falls below a minimum value. When the API Gravity of the metered product falls below the value entered in this field, an API Gravity alarm will be raised and loading will be stopped. See API Gravity Calibration for instructions on configuring an API Gravity sensor.
Alarm High API Gravity	When an API Gravity Sensor is enabled, this parameter can be used to raise an alarm when the measured API Gravity rises above a maximum value. When the API Gravity of the metered product exceeds the value entered in this field, an API Gravity alarm will be raised and loading will be stopped. See API Gravity Calibration for instructions on configuring an API Gravity sensor.
API Gravity Alarm Time	At the default value of zero seconds, API Gravity alarms will be raised instantly. A small delay can be added, in seconds, to avoid nuisance alarms that may occur when API Gravity is momentarily out of range. The API Gravity alarm timer will only run when an API Gravity alarm is not active and a batch is currently authorized on this preset.
API Gravity @ 4mA	Enter the API Gravity that will represent the lowest API Gravity value measured by the transmitter. This value will be equal to 4 mA.
API Gravity @ 20mA	Enter the API Gravity that will represent the highest API Gravity value measured by the transmitter. This value will be equal to 20 mA.
API Gravity Offset	This parameter provides a means to introduce an API Gravity offset to correct the indicated API Gravity to the observed API Gravity.

4.6.4 COMPONENT SETUP

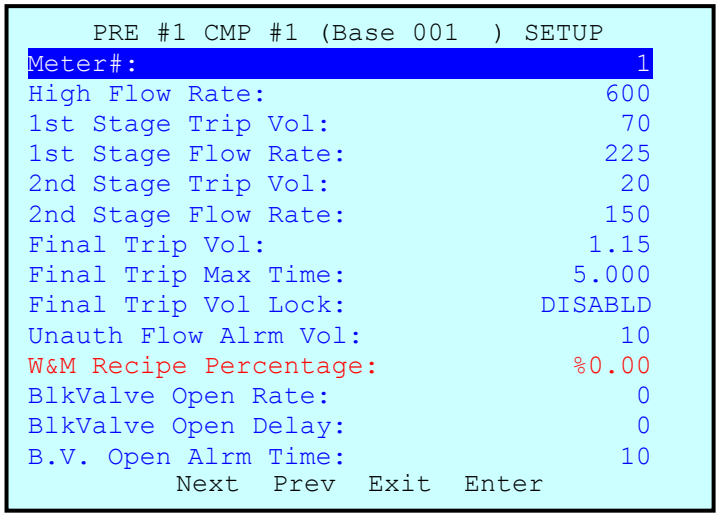
Use the Component Setup functions to configure the characteristics of a component.

Further details about flow control can be found in Chapter 5.

Component flow rates are configured in the Weights & Measures -> Component section and can be found in Chapter 8.

Navigate to this screen as: Program Mode -> Configuration -> Equipment Setup -> Select Parameter Level -> Components

The Component Setup screen displays:


PRE #1 CMP #1 (Base 001) SETUP
Meter#: 1
High Flow Rate: 600
1st Stage Trip Vol: 70
1st Stage Flow Rate: 225
2nd Stage Trip Vol: 20
2nd Stage Flow Rate: 150
Final Trip Vol: 1.15
Final Trip Max Time: 5.000
Final Trip Vol Lock: DISABLD
Unauth Flow Alrm Vol: 10
W&M Recipe Percentage: %0.00
BlkValve Open Rate: 0
BlkValve Open Delay: 0
B.V. Open Alrm Time: 10
Next Prev Exit Enter

Parameter	Action
Meter #	Assign the component to a flow meter.
High Flow Rate	Set to the same value as the high flow rate in the preset menu. It may be a different value if piping requirements dictate.
1st Stage Trip Vol	Enter a volume that will trigger the beginning of the First Stage Trip phase. The First Stage Trip phase will begin when the remaining preset volume is equal to the value specified in this parameter. The First Stage Trip phase is the initial reduction from the High Flow rate to a no flow condition. When the First Stage Trip Volume is reached, the flow control valve will reduce the flow rate from the High Flow Rate to a flow rate specified by the First Stage Flow Rate parameter. The First Stage Trip phase will end when the Second Stage Trip Volume is reached.
1st Stage Flow Rate	Enter the target flow rate for the First Stage Flow Rate.
2nd Stage Trip Vol	Enter a volume that will trigger the beginning of the Second Stage Trip phase. The Second Stage Trip phase will begin when the remaining preset volume is equal to the value specified in this parameter. The Second Stage Trip phase is the second in a series of adjustments from the High Flow rate to a no flow condition. When the Second Trip Volume is reached, the flow control valve will reduce the flow rate from the First Stage Flow Rate to a flow rate specified by the Second Stage Flow Rate parameter. The Second Stage Trip phase will end when the Final Trip Phase is reached.
2nd Stage Flow Rate	Enter the target flow rate for the Second Stage Flow Rate.

Parameter	Action
Final Trip Vol	Enter a volume that will compensate for the amount of time it takes the control valve to close from the Second Stage Trip phase, as the preset quantity is reached. Before entering a value for this parameter, adjust the closing speed of the control valve to the optimum setting, using procedures provided by the valve's manufacturer. This parameter will command the valve to close a little earlier to compensate for small, consistent over deliveries. Or it can be commanded to close a little later to compensate for small, consistent under deliveries. This adjustment is made on a volumetric basis
Final Trip Max Time	The Final Trip Stage is the last phase of delivery where product flow is authorized. The Final Trip Max Time parameter establishes the length of time, in milliseconds, that this phase is active. When the time specified in this parameter has elapsed, flow must be completely stopped. If there is no flow when the time expires, the preset will transition to the Idle state. If flow is still detected past this period, the Overrun Alarm will activate if the Overrun Alarm Volume has been exceeded.
Final Trip Vol Lock	Enable this parameter to prevent the MultiLoad II from automatically adjusting the Final Trip Volume parameter. When this parameter is enabled, the MultiLoad II will analyze the closing performance of the control valve and make adjustments to the Final Trip Volume as necessary.
W&M Recipe Percentage:	If this component is to have the recipe percentage under W&M protection, set this value to the W&M accepted value. When this value is non-zero, the Component Recipe Percentage MUST be equal to the W&M Recipe Percentage or all attempts to authorize a batch will be denied displaying a message of “W&M Required Component Pct Not Correct”.
Unauth Flow Alrm Vol	Specify the volume of Unauthorized Flow that will have to accumulate before an Unauthorized Flow Alarm is raised. Unauthorized Flow occurs when the flow meter senses the movement of product when the component has not been authorized for delivery.
Blk Valve Open Rate	Use this parameter when using hydraulic product selection valves, instead of MOVs. A value of zero disables this feature. Hydraulic valves used upstream of the digital control valve may not open fully during the Low Flow stage, due to low differential pressure across the product selection valve. This may prevent the Block Valve Status input from signaling that the product selection valve is open, although flow is occurring. Start with a value equal to the Low Flow Rate minus the Low Flow DB (deadband) Rate. Enter this value in the Block Valve Open Rate field. Block Valve Open Alarms will not be raised when the flow rate is below this value.
Blk Valve Open Delay	Set this parameter to delay the opening of a block valve by a period specified in seconds. When a block valve is employed, it will be commanded open after the delay time has expired. For the first component of a blend, the delay timer will commence at the moment that the Start button is pressed. For subsequent components, the timer will start as soon as flow has stopped for the previous component. Ignore this parameter if Block Valves are not used.
B.V. Open Alrm Time	Specifies the time in seconds to allow the component’s block valve to open. If a component block valve employs a feedback signal, an alarm will occur if the feedback requirement is not satisfied in this time.
B.V. Close Alrm Time	Specifies the time in seconds to allow the component’s block valve to close. If a component block valve employs a feedback signal, an alarm will occur if the feedback requirement is not satisfied in this time.
Pump Start Delay	The starting of the pump will be delayed by the time, in seconds, specified by this parameter.
Pump Stop Delay	After the batch has been completed, the pump will remain on for the period, in seconds, specified by this parameter.

Parameter	Action
Pump Start Alrm Time	This alarm setting is used in conjunction with a Pump Status input. If the Pump Status signal is not received in time specified by this parameter, a Pump Status alarm will be raised. The time is specified in seconds. Timing will begin as soon as the Start button is pressed. The setting for this parameter must exceed the setting of the Pump Start Delay time.
Flow Start Delay	Delays the opening of the flow control valve by a period, in seconds, specified by this parameter. The delay time begins when the Start button is pressed.
Unauth Reset Time	Unauthorized Reset Time. This parameter is intended to prevent nuisance unauthorized flow alarms for load arms that typically sit idle for long periods of time. Over time, stray pulses may accumulate and eventually trigger false unauthorized flow alarms in idle load arms. The value entered here determines how often an internal unauthorized flow alarm counter gets reset. The internal unauthorized flow alarm counter is not user viewable and is not to be confused with Unauthorized Flow Totalizers, which do not get reset by this function. This parameter will reset the internal counter periodically as specified by the value entered herein to prevent nuisance alarms. Enter a value in seconds. The possible range of entries is 600-65,535 seconds.
Fallback Rate	If during the High Flow stage, the flow rate is below the High Flow Deadband Rate for the period specified by the Fallback Time parameter, the control algorithm will fall back to the flow rate specified in this parameter. This parameter is intended to be used with turbine flow meters. When the High Flow rate is unobtainable, the flow rate will revert to the specified flow rate, which should have a proven meter factor. If the flow meter is a Positive Displacement (PD) meter, set this parameter to zero and review the Fallback Time parameter. After specifying a Fallback Rate for a turbine meter application, configure Fallback Time, Fallback Retry Time and Fallback Retry Volume.
Fallback Time	If during the High Flow stage, the flow rate is below the High Flow Rate deadband for the period specified by this parameter, the control algorithm will search for a controllable rate. Begin with a value of 3 seconds. An entry of zero seconds will disable the Fallback feature.
Fallback Retry Time	After a controllable rate has been obtained, it will be maintained for a period determined by the setting of this parameter. Upon the expiration of the Fallback Retry Time, the algorithm will attempt to regain the target flow rate. If the target flow rate cannot be regained in the time allotted by the Fallback Time parameter, the algorithm will search again for a controllable rate. Begin with a value of 45 seconds. An entry of zero seconds will disable the Fallback feature.
Fallback Retry Volume	This parameter tells the control algorithm when to stop trying to reacquire the target flow rate. When the remaining volume of the load is equal to the value specified by this parameter, no further attempts will be made. Set the parameter to the same value as the 1st Stage Trip Volume, plus 50 gallons. An entry of zero will disable the Fallback feature.
API Table Name	Select the desired API table to correct liquid volumes to a reference temperature or pressure. Highlight the field and press Enter to scroll through the choices.
API 54 YG	Product name needs to be selected In conjunction with the API table 54YG

Parameter	Action
API BIO	This API BIO tables are used for Methode3 from the PTB Community. Select API Table Name PTB-BIO table combined with API BIO to choose the wanted product. Formula: $V(T) = V_0 *\{1 + [A_1 *(T - T_0) + A_2 *(T - T_0)_2 + A_3 *(T - T_0)_3]\}$ V0 = Volume @ base temperature V(T) = Volume @ observed temperature T0 = Base Temperature (15° C) T = Observed Temperature A1, A2, A3 = Biofuel coefficients
API Extrapolated Range	When enabled, VCF values from extrapolated table ranges can be used for CTL and CPL calculations without raising an API Table Alarm.
API Gravity	For API tables that require the entry of an API Gravity value, enter that value here. The value should be the API Gravity of the component at 60 ° F. The units are degrees API.
Relative Density	For API tables that require the entry of a relative density, enter that value here. The value should be the relative density of the component at 60 ° F. Note that Relative Density is unit less.
Default Density	For API tables that require the entry of density, enter that value here. The value should be the density of the component at 15 ° C. The units are kg/m3. When this value is non-zero, this value will be reported as the component level density and may be used as the meter level density if a density is not defined at the meter level. If this value is zero, the meter level density will be used as the component level density. If this is the main component on a side stream blend, a density will be back calculated from the meter level density and the side stream meter or component density.
Expansion Coef.	For API tables that require the entry the coefficient of expansion, enter that value here. The value should be the coefficient of expansion of the component @ 60°F or 15° C, depending on the table.
Hydrometer Used	In cases where a Hydrometer is used to determine API Gravity or Density, enable this Parameter.
Commodity Type	Only used for API X tables: No type, Crude, Refined and Lubric
Expansion Coef. UOM	Only used for API X tables: C or F
Density UOM	Only used for API X tables: kg/m³ ,API Gravity and Relative Density
Pressure UOM	Only used for API X tables: BAR, PSIG and kPA
Reference Temperature	This is used for the API X tables, but also for the ethanol tables.(TEC B40 , TEC B100, TEC E40, TEC E100)
Alcohol Percentage	This percentage value is only used for the Brazilien alcohol table , this value is need to determine the vcf factor.
API Delay Alarm	This parameter is use for unloading Bays when the density, gravity or relative density device gives an invalid value, because of Air in the line. By increase this parameter in seconds it is possible to still offload without going into alarm. Last known density will be used for calculation.
Close Block Valve FCM#	Permits selection of a port that will provide an output signal to close a component's block valve. This feature is provided for block valves that require separate opening and closing signals.

Parameter	Action
Blk Val Status FCM#	Block Valve Status FCM# parameter allows the selection of a port that will receive an input signal. The input signal will represent the state of the component block valve, indicating whether it is open or closed. When the block valve is closed, an external contact attached to the valve will close, applying a status signal to the input. When the block valve is open, the external contact will also be open, removing the status signal from the input. When the block valve has been commanded to open, the absence of a signal at the input will indicate that the valve has opened. If the "closed" signal is still present after the Block Valve Open Delay time has elapsed, a block valve failure alarm will be issued. When the block valve has been commanded to close, the presence of the status signal at the input will indicate that the valve has closed. If the "closed" signal has not been detected by the time the Block Valve Close Delay time has elapsed, a block valve failure alarm will be issued.
Open Blk Val FCM#	Permits selection of a port that will provide an output signal to control a component's block valve. This output will provide a signal to open the block valve. When MultiLoad II commands the valve to close, the signal will be removed.
Pump Run FCM#	Permits the selection of a port that will provide an output signal to a pump starter.
Pump Kill FCM#	Permits the selection of a port that will provide an output signal to stop the pump. The output signal will be sent to stop the pump whenever the Valve Fault Alarm is raised, regardless of what other bays are commanding the pump to run.
Pump Status FCM#	Permits the selection of a port that will provide an input for monitoring pump pressure. A port that has been assigned the Pump Status function will receive a signal (high or low) from a pressure sensing instrument, when pump pressure has reached a sufficient level. The parameter Pump Start Alarm Time must be configured when using this feature.
Alarm Out FCM#	Provides an output signal if the component has an active alarm. This parameter selects an output port that will be assigned to signal an unspecified alarm condition from the component.
Authorized FCM#	Authorized FCM provides an output signal if the component has been authorized for flow as a result of driver card-in or product selection. This parameter selects an output port that will be assigned to signal the condition.
Permiss FCM#	Allows the selection of a port that will receive an input signal. The input signal will represent the state of the component's permissive. If the signal is not present at authorization or if the signal is lost during delivery, the process will be stopped and a permissive component level alarm will be raised.
Permiss Out FCM#	This parameter permits the selection of a port that will provide an output signal. The signal will represent the loss of the component's permissive.
Meter Factor #1	Enter the meter factor that was calculated when proving at the Meter Factor #X flow rate. The meter factor is used to correct the volume indicated at the MultiLoad II display to correspond with the observed gross volume. The observed gross volume is typically determined by a proving device. If linearization is not used, leave this parameter at the default setting of 1.0000. Leave the remaining Meter Factor parameters at their default settings. The allowable range of entries is 0.8000–1.200
Meter Factor #1 Rate	Enter the flow rate that was used during proving to find Meter Factor #1. This is the first linearization point. Meter Factor #1 will be used to correct the indicated volume for flow rates ranging from zero up to and including the Meter Factor #1 Flow Rate. If linearization is not used, leave this parameter set at the default setting of 150. Leave the remaining Meter Factor parameters at their default settings.

Parameter	Action
Meter Factor #2	Enter the meter factor that was calculated when proving at the Meter Factor #2 flow rate. The meter factor is used to correct the volume indicated at the MultiLoad II display to correspond with the observed gross volume. The observed gross volume is typically determined by a proving device. If this linearization point is not used, leave this parameter at the default setting of 1.0000. Leave the remaining Meter Factor parameters at their default settings. The allowable range of entries is 0.8000–1.200
Meter Factor #2 Rate	Enter the flow rate that was used during proving to find Meter Factor #2. This is the second linearization point. When the flow rate is between Meter Factor #1 Flow Rate and Meter Factor #2 Flow Rate, MultiLoad II will interpolate a meter factor based on the current flow rate. If this linearization point is not used, leave this parameter at its default setting of 200. Leave the remaining Meter Factor parameters at their default settings.
Meter Factor #3	Enter the meter factor that was calculated when proving at the Meter Factor #3 flow rate. The meter factor is used to correct the volume indicated at the MultiLoad II display to correspond with the observed gross volume. The observed gross volume is typically determined by a proving device. If this linearization point is not used, leave this parameter at the default setting of 1.0000. Leave the remaining Meter Factor parameters at their default settings. The allowable range of entries is 0.8000–1.200
Meter Factor #3 Rate	Enter the flow rate that was used during proving to find Meter Factor #3. This is the third linearization point. When the flow rate is between Meter Factor #2 Flow Rate and Meter Factor #3 Flow Rate, the MultiLoad II will interpolate a meter factor based on the current flow rate. If this linearization point is not used, leave this parameter at its default setting of 400. Leave the remaining Meter Factor parameters at their default settings.
Meter Factor #4	Enter the meter factor that was calculated when proving at the Meter Factor #4 flow rate. The meter factor is used to correct the volume indicated at the MultiLoad II display to correspond with the observed gross volume. The observed gross volume is typically determined by a proving device. If this linearization point is not used, leave this parameter at the default setting of 1.0000. Leave the remaining Meter Factor parameters at their default settings. The allowable range of entries is 0.8000–1.200.
Meter Factor #4 Rate	Enter the flow rate that was used during proving to find Meter Factor #4. This is the fourth linearization point. When the flow rate is between Meter Factor #3 Flow Rate and Meter Factor #4 Flow Rate, the MultiLoad II will interpolate a meter factor based on the current flow rate. Meter Factor #4 will be used for all flow rates that exceed the Meter Factor #4 Flow Rate. If this linearization point is not used, leave this parameter at its default setting of 800.
# Meter Factors Used	Enter the number of meter factors that are to be established by flow meter proving. If proving a single flow rate, enter a 1 in this field. Data that are in the fields related to meter factors 2, 3 and 4 will be ignored. If proving two flow rates, enter a 2 in this field. Data that are in the fields related to meter factors 3 and 4 will be ignored. If proving three flow rates, enter a 3 in this field. Data related to meter factor 4 will be ignored. If proving four flow rates, enter a 4 in this field.

4.7 ALARM SETUP

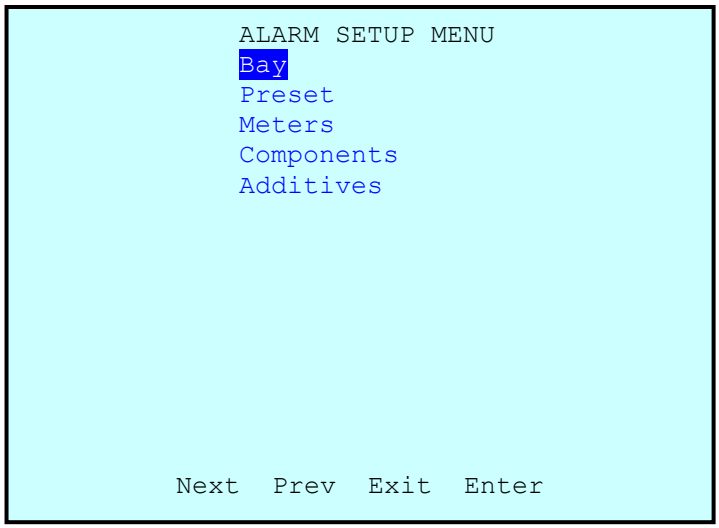
Use the Alarm Setup functions to define alarm conditions and authorities at the various configuration levels: Bay, Preset, Meter, Component and Additive. All alarm setup screens, will indicate who has the authority to clear the alarm or how the alarm is to be cleared. The following table shows these authorities in increasing order of severity and/or importance.

AUTO	The alarm will be cleared automatically when the condition rights itself.
DRIVER	The driver may clear the alarm.
REMOTE	This alarm can be cleared remotely by the host system (TMS),
PROGRAM	This alarm can be cleared when the Program Switch is activated,
W&M	This alarm can be cleared when the W&M Switch is activated.

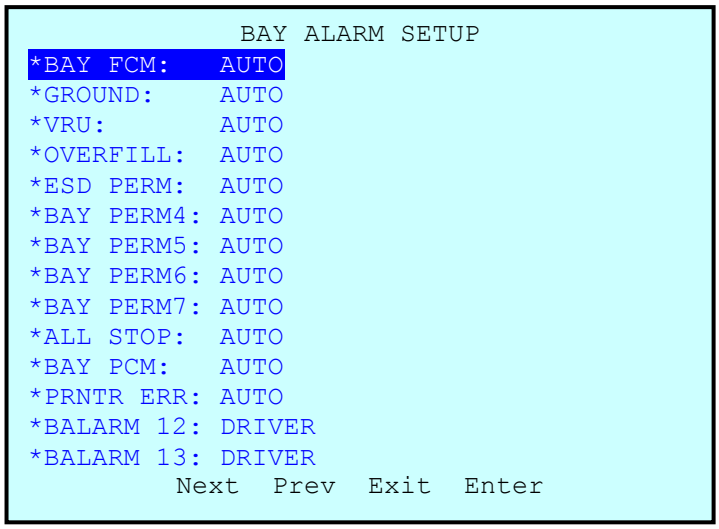
- Some alarms cannot be settable to Auto Clear. This happens when the alarm is not default at AUTO Clear.
- It is not possible to set an alarm level to W&M or chance parameters on an alarm when the alarm level is set to W&M, unless the W&M switch is active. Changes in both of these cases will be logged in the W&M change log.

Navigate to this screen as: Program Mode -> Configuration -> Alarm Setup

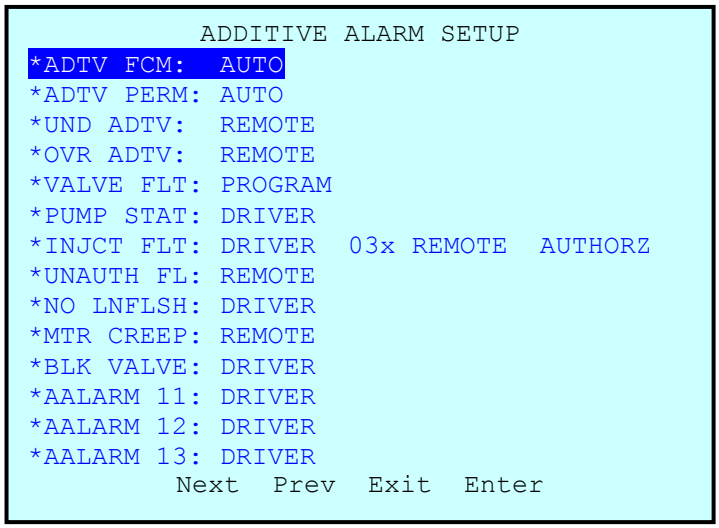
The Alarm Setup screen displays:



The Bay Alarm Setup screen displays: (Preset, Meter, Component and Additive screens are similar.)



An optional alarm setup feature is the ability to promote an alarm after a number of alarm occurrences to another level. In the Additive Alarm Setup screen shown below the Injection Fault alarm will be Driver clearable for the first 3 occurrences, but then is promoted to Remote clearable. The occurrence count and return to the original alarm level will be reset on the next transaction authorization.

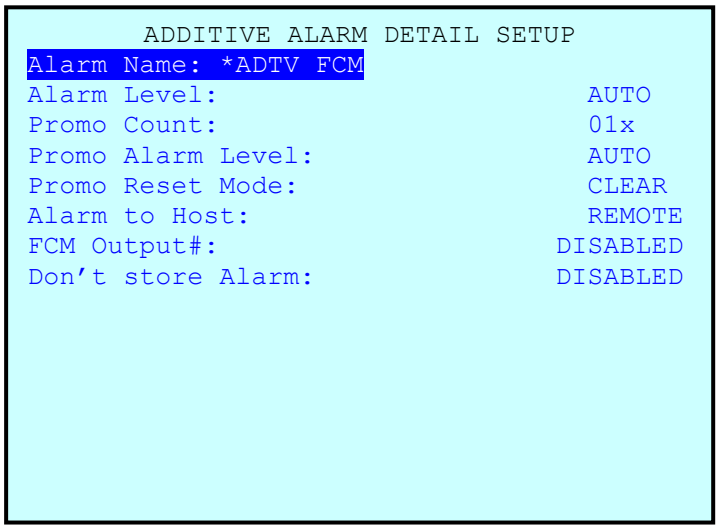


The alarm occurrence count can be reset by the following:

2 MIN	After 2 minutes of continuous system time.
5 MIN	After 5 minutes of continuous system time.
15 MIN	After 15 minutes of continuous system time.
30 MIN	After 30 minutes of continuous system time.
60 MIN	After 60 minutes of continuous system time.
3 HRS	After 3 hours of continuous system time.
6 HRS	After 6 hours of continuous system time.
12 HRS	After 12 hours of continuous system time.
24 HRS	After 24 hours of continuous system time.
AUTHORZ	Until the next transaction is authorized.
CLEAR	When the alarm is cleared,

In the following topics, only Bay Alarm Setup screen is shown.

To change each alarm you need to push ENTER to go into the ALARM DETAIL SETUP SCREEN



Alarm	Meaning
Alarm Name	This is the name of the alarm only a few alarms can be renamed.
Alarm Level	This is the general level of the alarm, how it can be cleared. If the alarm is by default not in AUTO level, it can be never put into this level
Promo Count	The amount of times the alarm needs to happen before it cose into the Promo Alarm Level.
Promo Alarm Level	This is actually has the same levels as the Alarm Level, but is only be used when the promo count is reached.
Promo Reset Mode	The parameter indicates how the promo count can be resetted again to zero.
Alarm Host	The parameter Alarm to Host , can be set to Remote which means that the alarm is send to the host. Alarm Local means the alarm will be seen by any host-system.
FCM Output#	If this the general happens on the Multiload we will send a general output to a PLC
Don't store Alarm	This feature will disable the storage and printing of a certain alarm if it is not wanted. Has affect on Printing Bol, Printing Alibi Log, storage alarm.

If the Promo Count value is ZERO, Promo Alarm Level and Promo Reset Mode will be not displayed.

4.7.1 BAY ALARM SETUP

Default values are in the left column

Alarm	Meaning
BAY FCM **AUTO**	The MultiLoad II has lost communication with the I/O board or FCM. This message indicates that bay level functions are affected by the interrupted communication. This alarm will automatically clear when communication with the I/O board is restored. Check the Diagnostic menu under FCM Com to determine if the I/O Board or FCM is communicating.
BAY PERM 0-7 **AUTO**	When the permissive signal(s) assigned to bay permissives 0 through 7 is/are lost, loading will stop and a message will be displayed. The alarm will auto clear when the affected signal is restored. The alarm message that appears to the operator is configured via the MultiLoad Configuration Tool, at Bay Alarms. Default names include "*GROUND, *VRU, *OVERFILL, *ESD PERM".
ALL STOP **AUTO**	This feature is not available.
BAY PCM **AUTO**	The MultiLoad II RCU has lost communication with a configured PCM board.
PRNTR ERR **AUTO**	The printer connected to a PCM module is in error (offline, out of paper, etc.).
*GPS_ERROR (ML II Mobile Only) **AUTO**	Is raised when GPS communication is configured and one of the following occur: - No GPS fix data arrives for 60 seconds. - "Max GPS Site Distance" is configured as a non-zero value, and a transaction is authorized when the current position is not within this distance from a site in the GPS Site Database - Current position has moved from the site where authorization was obtained.
BALARM 13,15-31 **Driver**	Future bay level alarm assignments.
DEADMAN **Driver**	This Alarm will go on when the driver didn't push in time the deadman button.
FCM Trace	This alarm will appear when certain diagnostic features are activated by Toptech support. This alarm should not occur during normal operations.

4.7.2 PRESET ALARM SETUP

Alarm	Meaning
PRE FCM **AUTO**	The MultiLoad II has lost communication with the I/O board or FCM. This message indicates that preset level functions are affected by the interrupted communication. This alarm will automatically clear when communications are restored. Check the Diagnostic menu under FCM Com to determine if the I/O board or FCM is communicating.
PRE PERM **AUTO**	Preset Permissive. When the Preset Permissive signal is lost, loading will stop. The alarm will auto clear when the signal returns. The alarm message that appears to the operator is configured via the MultiLoad Configuration Tool, at Preset Alarms, Alarm 1.
SWING ARM (Excluding SMP) **AUTO**	The swing arm alarm will activate when the swing arm is not in the proper position for loading. The alarm will auto clear when the swing arm is positioned properly.
NO LNFLSH (Excluding SMP) **DRIVER**	No Line Flush alarm. This alarm will occur when the Minimum Line Flush Volume has not been met for the load. Check the Status screen for the amount of line flush that needs to occur to have a properly flushed line.
BLK VALVE **DRIVER**	Block Valve Alarm. This alarm activates when a Preset level block valve has not opened in the time dictated by the Block Valve Open Alarm Time parameter. This alarm will also occur if the block valve has not closed in the time required by the Block Valve Close Alarm Time parameter. Any time a block valve is in the improper position, the alarm will activate.
BAY ALARM **AUTO**	This alarm setting should remain at Auto Clear. This alarm indicates that the preset has a Bay Level alarm active.
COMP ALARM **AUTO**	This alarm setting should remain at Auto Clear. This alarm indicates that the preset has a Component Level alarm active.
ADD ALARM **AUTO**	This alarm setting should remain at Auto Clear. This alarm indicates that the preset has an Additive Level alarm active.
MTR STOP **AUTO**	Meter Stop. This message will be displayed when the meter stop button has been pressed. An external stop button can be configured for each preset; this is an optional feature. The driver can clear the alarm by default and resume loading when desired.
OVERRUN **REMOTE**	The overrun alarm will occur when the quantity delivered has exceeded the preset quantity by a value configured in the Overrun Volume Alarm parameter. This alarm is intended to alert maintenance personnel that a control valve may not be closing as quickly as it should. The valve may require maintenance. The setting of this alarm should be less than the Valve Fault alarm, which is intended to indicate a more serious control valve failure.
EXCESS FL **REMOTE**	The Excess Flow alarm will occur when flow through the load arm has exceeded the maximum flow rate configured in the Preset Level Excess Flow parameter. This alarm can also occur with bad pulse transmitters or loose pulser connections.
PALARM 11-31 **DRIVER**	Future preset level alarm assignments.
INVCONFIG	This alarm indicates that an invalid configuration has been detected. Inappropriate meter factor changes are often the cause of this alarm. When this alarm occurs, enter the program mode and select Views & Inquires -> Message Log. The Message Log will indicate the source of the INVCONFIG alarm.

4.7.3 METER ALARM SETUP

Alarm	Meaning
MTR FCM **AUTO**	The MultiLoad II has lost communication with the I/O board or FCM. This message indicates that meter level functions are affected by the interrupted communication. This alarm will automatically clear when communications are restored. Check the Diagnostic menu under FCM Com to determine if the I/O board or FCM is communicating.
MTR PERM **AUTO**	Meter Permissive. When the Meter Permissive signal is lost, loading will stop on the load arm if the meter is being used. The alarm will auto clear when the signal returns. The alarm message that appears to the operator is configured via the MultiLoad II Configuration Utility, at Meter Alarms, Alarm 1.
FCM CONF **REMOTE**	FCM reporting an invalid configuration. This alarm is the result of a configuration error. Most likely, the error is related to meter factors. If meter factor flow rates are not entered in ascending order, this alarm will occur. For example, Meter Factor Flow Rate #2 must be greater than Meter Factor Flow Rate #1. If meter factors vary significantly from one another, this alarm may occur. Check the meter factor parameters for entry errors.
FCM WDT **REMOTE**	FCM Watch Dog Timer Timeout. This alarm indicates that an error has occurred with the processor on the I/O board or FCM. Reset the alarm and attempt to resume operation. If the alarm recurs repeatedly, it may be necessary to replace the I/O board or FCM. Contact Toptech technical support for assistance.
FCM TMOUT **REMOTE**	FCM Timeout. This alarm is initiated by the I/O board or FCM if it is not receiving communication from the MultiLoad II and is forced to de-energize outputs for safety. The I/O board will only initiate this alarm when it is actively controlling flow or energizing outputs. Flow will be stopped on the I/O board if this alarm occurs. When communications are restored between the I/O board and the MultiLoad II, it will be possible to clear the alarm and resume operations.
VALVE FLT **PROGRAM**	Valve Fault. The control valve has been commanded to shut but flow has not stopped. The alarm will activate when the volume specified in the Valve Fault Alarm Volume parameter has passed the meter, after the valve has been commanded to close. When the alarm occurs, component block valves will be commanded to close and the relevant pump will be commanded to stop. The Pump Kill output will be activated, if it is used. A Pump Stat alarm message will occur on other load arms that are using the common Pump Run output. For example, if a Valve Fault occurs on load arm #1 (diesel), all other diesel load arms in the bay will display the Pump Stat alarm and will not be able to load until corrective action is taken. This alarm may indicate that the control valve requires maintenance and is in an unsafe condition.
LOW FLOW **DRIVER**	The flow rate has remained below the Low Flow Alarm Rate for a period specified by the Low Flow Alarm Time parameter. The pump may have stopped or the valve may be shut. A meter pulser failure may also cause this alarm.
EXCESS FL **REMOTE**	Excess Flow: at the meter level, this alarm indicates that the maximum flow rate of the flow meter has been violated. This alarm can also occur with bad pulse transmitters or loose pulser connections.

Alarm	Meaning
QUAD ENC **REMOTE**	Quadrature Encoder error, also known as pulse security error. This alarm applies to flow meters that use dual-channel pulsers. One of the pulser channels has failed or is failing intermittently. This alarm occurs in new installations when pulser channel A is wired to pulser channel B and vice versa. This alarm will also be raised if reverse flow is detected. 1. Verify that meter pulsers or pre-amps are receiving power. 2. Verify pulser connections to the I/O board. 3. Ensure that channel A and channel B pulsers are not wired in reverse. 4. Check for evidence of reverse flow by viewing the meter totalizer (backflow gross).
DENSITY **REMOTE**	This alarm indicates that the value measured by the Density or Relative Density Sensor has deviated from the range specified by Alarm Low Density and Alarm High Density or Alarm Low Relative Density and Alarm High Relative Density parameters. Other potential causes include a disconnected sensor or an inappropriate value in the Default Density or Default Relative Density field. Go to program mode menu Views & Inquiries -> Density or Relative Density to observe the current density reading.
RTD ERROR **REMOTE**	This alarm indicates that the temperature measured by the RTD has deviated from the range established by the Alarm Low Temp and Alarm High Temp parameters. Other causes include a disconnected sensor or misconfigured Temp Module Type parameter. Go to program mode menu Views & Inquiries ->Temperature for further diagnostic messages.
VALVE CTL **REMOTE**	Valve Control error-This alarm indicates that the control valve was unable to maintain flow within the Dead Band (DB) Rates prescribed in the Meter menu. This alarm may indicate a need for valve maintenance or that insufficient pressure is available to control the valve. Use the Component Status screen to determine if the valve is able to achieve target flow rates specified by High Flow Rate, Low Flow Rate and the 1st and 2nd Trip Rates. If valve is operating in a wide open position and cannot achieve flow targets, the valve is vulnerable to control problems, due to weak differential pressure. If this is the case, reduce flow rate targets to achievable values or enable the Fallback feature in the Component menu.
MTR CREEP **REMOTE**	This alarm indicates that volume has passed through the flow meter while the valve was not commanded to open. It may be an indication of a small leak or it may indicate that erroneous flow signals have been noted by the system. The amount of volume that triggers the alarm is configured in the Meter Creep Alarm Volume parameter. See also Creep Reset Time parameter.
PRES ALRM **REMOTE**	This alarm indicates that the pressure measured by the pressure transmitter has deviated from the range established by the Alarm Low Pressure and Alarm High Pressure parameters. Verify transmitter operation.
QUAD CHA **REMOTE**	This alarm message indicates that pulses from the referenced meter's A channel pulser are not being received at port 4 of the FCM or they are being received intermittently. If this alarm is received along with QUAD CHB alarm, the meter channels are either wired in reverse or backflow is occurring. See QUAD ENC alarm.
QUAD CHB **REMOTE**	This alarm message indicates that pulses from the referenced meter's B channel pulser are not being received at port 5 of the FCM or they are being received intermittently. If this alarm is received along with QUAD CHA alarm, the meter channels are either wired in reverse or backflow is occurring. See QUAD ENC alarm.
MTR COM **AUTO**	No communication with Meter that is connected via a communication line
BSW	This alarm indicates that the value measured by the BSW Sensor has deviated from the

REMOTE	range specified by Alarm Low BSW and Alarm High BSW parameters. Other potential causes include a disconnected sensor or an inappropriate value in the Default BSW field. Go to program mode menu Views & Inquiries -> BSW to observe the current BSW reading.
GRAVITY **REMOTE**	This alarm indicates that the value measured by the BSW Sensor has deviated from the range specified by Alarm Low API Gravity and Alarm High API Gravity parameters. Other potential causes include a disconnected sensor or an inappropriate value in the Default API Gravity field. Go to program mode menu Views & Inquiries -> API Gravity to observe the current API Gravity reading.
MALARM 19-31	Future meter level alarm assignments.

4.7.4 COMPONENT ALARM SETUP

Alarm	**Meaning**
COMP FCM **AUTO**	The MultiLoad II has lost communication with the I/O board or FCM. This message indicates that component level functions are affected by the interrupted communication. This alarm will automatically clear when communications are restored. Check the Diagnostic menu under FCM Com to determine if the I/O board or FCM is communicating.
COMP PERM **AUTO**	Component Permissive. Permissives can be set to affect specific components in multi-component load arms. When the Component Permissive signal is lost, loading will stop on the load arm if the component is being used. The alarm will auto clear when the signal returns. The alarm message that appears to the operator is configured via the MultiLoad Configuration Tool, at Component Alarms, Alarm 1.
BLK VALVE **DRIVER**	Block Valve alarm. This alarm activates when a component block valve has not opened in the time required by the Block Valve Open Alarm Time parameter. This alarm will also occur if the block valve has not closed in the time required by the Block Valve Close Alarm Time parameter. Any time a block valve is in the improper position, the alarm will activate.
UNAUTH FL **REMOTE**	Unauthorized Flow Alarm-This alarm will occur when flow passes through the meter when the meter is not authorized for loading. The volume that will trip the alarm is determined by the Unauthorized Flow Alarm Volume.
PUMP STAT **DRIVER**	The Pump Status alarm will occur in two situations. Most commonly, the alarm occurs in conjunction with a Valve Fault alarm. If a control valve fails to close, the relevant pump output will be dropped in an effort to stop flow. The Pump Stat alarm will appear on all of a bay's load arms that make use of the same pump output. For example, if a Pump Stat alarm appears on load arm #7 (diesel), it may have occurred due to a Valve Fault on another diesel arm that is in the same bay. The Pump Stat alarm will also occur when using the Pump Status input to monitor a pump's pressure. When the pump loses pressure, the Pump Status alarm will appear on all of a bay's load arms that rely on the pump.
MTR ALARM **AUTO**	This alarm setting should remain at Auto Clear. This alarm indicates that the component has a Meter Level alarm active.
OVR BLEND (Excluding SMP) **DRIVER**	Over Blend alarm-This alarm will occur when a component of a Ratio Blend is above tolerance by the percentage specified by the Blend Check Alarm % parameter or by the volume specified by the Blend Check Alarm Volume parameter. For Sequential Blends, this alarm will be raised when a batch is cleared and the blend is above tolerance by the percentage or volume specified by aforementioned parameters.
UND BLEND (Excluding SMP) **DRIVER**	Under Blend alarm-This alarm will occur when a component of a Ratio Blend is below tolerance by the percentage specified by the Blend Check Alarm % parameter or by the volume specified by the Blend Check Alarm Volume parameter. For Sequential Blends, this alarm will be raised when a batch is cleared and the blend is below tolerance by the percentage or volume specified by aforementioned parameters.

Alarm	Meaning
API TABLE **DRIVER**	This alarm indicates that some parameter of either the CTL or CPL table is out of range. The cause of the alarm could be the result of a misconfigured table parameter or it could be the result of pressure or temperature sensor failure. When this alarm occurs, enter the program mode and select Views & Inquires/Message Log. The Message Log will indicate the preset and component that has the active API Table alarm. If a Pressure or RTD alarm is raised in addition to the API Table Alarm, resolve the pressure and/or temperature issues first. If there is no pressure or temperature alarm, enter the Weights & Measures section in program mode. Enter the Temp Comp menu of the Preset and Component that has the alarm. Verify the settings of Gravity or Density or Expansion Coefficient. Ensure that the settings are appropriate for the selected table. If pressure correction is used, check settings in the Pressure Comp menu as well. Check the Gravity or Density settings. Ensure that the settings are appropriate for the selected table.
CALARM 9-31 **DRIVER**	Future component level alarm assignments.

4.7.5 ADDITIVE ALARM SETUP

Alarm	Meaning
ADTV FCM **AUTO**	The MultiLoad II has lost communication with the I/O board or FCM. This message indicates that additive level functions are affected by the interrupted communication. This alarm will automatically clear when communications are restored. Check the Diagnostic menu under FCM Com to determine if the I/O board or FCM is communicating.
ADTV PERM **AUTO**	Additive Permissive. Permissives can be set to affect specific additives in multi-additive load arms. When the Additive Permissive signal is lost, loading will stop on the load arm if the additive is being used. The alarm will auto clear when the signal returns. The alarm message that appears to the operator is configured via the MultiLoad Configuration Tool, at Additive Alarms, Alarm 1.
UND ADTV **REMOTE**	Under Additized alarm-The load is stopped when the additive becomes under additized by the number of injections specified by the Under Add. Alarm # Inj.
OVR ADTV **REMOTE**	Over Additized alarm-The load is stopped when the additive becomes over additized by the number of injections specified by the Under Add. Alarm # Inj.
VALVE FLT **PROGRAM**	Additive Valve Fault occurs when additive flow continues after the injection solenoid has been commanded to close. When the volume specified in Valve Fault Alarm Volume has passed the additive meter after it has been commanded shut, an alarm will be raised. The relevant block valve and pump outputs will be dropped in an attempt to stop flow. The Pump Kill output will be activated, if it is used. A Pump Stat alarm message will occur on other load arms that are using the common Pump Run output. For example, if an Additive Valve Fault occurs on a load arm's injector that delivers Brand X additive, all other load arms in the bay that deliver Brand X additive will display the Pump Stat alarm and will not be able to load until corrective action is taken.
PUMP STAT **DRIVER**	The Additive Pump Status alarm will occur in two situations. Most commonly, the alarm occurs in conjunction with a Valve Fault alarm. If an injection valve fails to close, the relevant pump output will be dropped in an effort to stop flow. The Pump Stat alarm will appear on all of a bay's load arms that make use of the common Pump Run output. For example, if a Pump Stat alarm appears on load arm #7, it may have occurred due to an Additive Valve Fault on another arm that is in the same bay. The Pump Stat alarm will also occur when using the Pump Status input to monitor a pump's pressure. When the pump loses pressure, the Pump Status alarm will appear on all of a bay's load arms that rely on the pump.

Alarm	Meaning
INJCT FLT **DRIVER**	This alarm indicates that MultiLoad II has detected that an injection failure has taken place. If a piston injector is used, the alarm indicates that a number of injections have been missed. The quantity of missed injections is specified by the parameter Max Pstn Missed Inj. Other failures that could cause this alarm are a stuck piston, solenoid/spool valve failures, clogged filters and injectors. Additionally, an improperly adjusted or broken piston position reed switch may be the source of the failure. In some cases, it may be necessary to increase the Max Piston Throw Time parameter when very low additive pressure exists. If the additive is very viscous or if a large volume injector is used it may be necessary to increase the Piston Throw Time. This will allow the injector more time to complete an injection cycle. If the additive metering method is used, this alarm indicates that additive injection target volume has not been reached within the period specified by the Max Solenoid Injection Time. In most cases this will indicate that an additive valve is closed or the additive pump is not starting. Other failures that could cause this alarm are solenoid failures, clogged filters, and malfunctioning meter pick-off or pre-amplifier. In some cases it may be necessary to increase the Max Solenoid Injection Time when front-loading, or when injecting large quantities of additive prior to a line flush. This will allow the injector more time to complete an injection cycle.
UNAUTH FL **REMOTE**	Unauthorized Flow-This alarm occurs when a volume of additive passes the meter and the additive is not authorized for delivery. The volume of flow that will trigger the alarm is specified in the Unauthorized Flow Alarm Volume parameter.
NO LNFLSH **DRIVER**	No Line Flush - This alarm occurs if the load is aborted and the Minimum Line Flush did not have the opportunity to occur.
MTR CREEP **DRIVER**	This alarm indicates that volume has passed the meter or piston when it was not commanded to inject. It may be an indication of a small leak or it may indicate that erroneous flow signals have been noted by the system. The amount of volume that triggers the alarm is configured in the Meter Creep Alarm Volume parameter. See also Creep Reset Time parameter.
BLK VALVE **DRIVER**	Block Valve alarm. This alarm activates when an additive block valve has not opened in the time required by the Block Valve Open Alarm Time parameter. This alarm will also occur if the block valve has not closed in the time required by the Block Valve Close Alarm Time parameter. Any time a block valve is in the improper position, the alarm will activate.
ALARM 11-31 **DRIVER**	Future additive level alarm assignments.

4.8 LOCAL PRODUCT DEFINITION AND ASSIGNMENT

The purposes of the Product Setup functions are to:

- Define base components, base additives, single products, and blended products for Local control installations.
- Assign components, additives, and/or authorized products to existing presets.

Toptech recommends that you complete the Equipment Setup functions (Bay, Presets, Meters, Components, Additives) *before* using the Product Setup functions.

These functions should be used only in Local, stand-alone mode. In Remote mode, product setup information should be supplied by the TMS.

In order to define Alphabetic product names and descriptions locally, it is necessary to use the MultiLoad Configuration Tool.

Navigate to this screen as: Program Mode -> Configuration -> Products

The Product Setup Menu screen displays:

This set of functions enables the user to define base components, additives, single saleable products (“Product”), and blended saleable products (“Blnd”), which are composed of two or more base components, with or without additive(s).

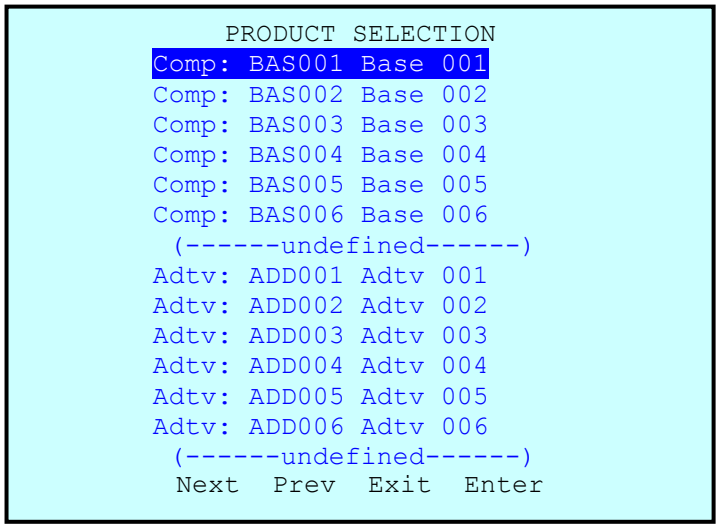
For MultiLoad II installations working with TMS, product setup information is loaded automatically via TMS; therefore, product setup information does not have to be configured manually in the MultiLoad II. If communication with TMS fails, the product information will be immediately available for stand-alone operation.

4.9 PRODUCT SETUP

Use the Product Setup functions to define products when the MultiLoad II is configured for Local, stand-alone mode. The strategy here is to define base components and base additives first, and then use these as building blocks to define products.

Navigate to this screen as: Program Mode -> Configuration -> Products -> Product Setup

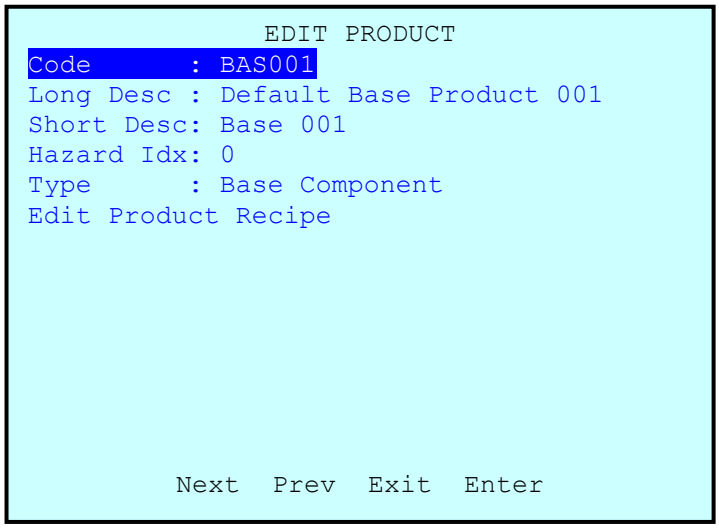
The Product Setup screen displays:



What is originally displayed is the default Base Products, Base Additives and Saleable Products.

Press **Enter** will select the product to edit.

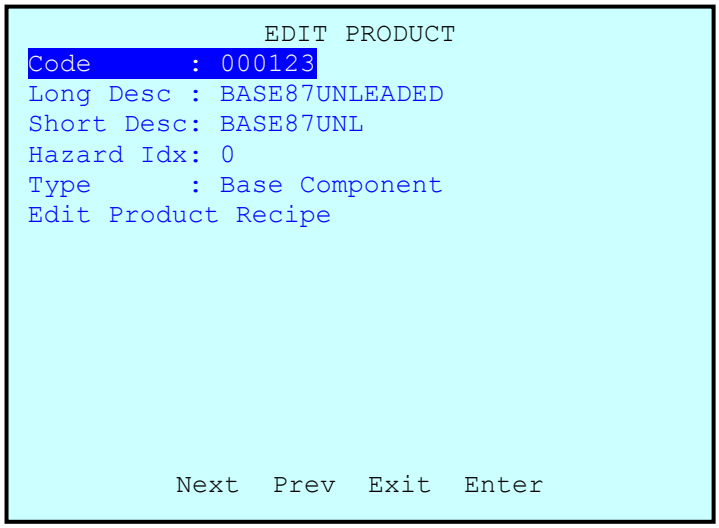
The Edit Product screen displays:



4.10 DEFINING BASE COMPONENTS

In the sample screen below, an operator has filled in the values to create an unleaded 87 base component.

Note, since the MultiLoad II SMP enclosure keypad does not support Alpha characters, specification of Alpha characters on product names MUST be done through the MultiLoad Configuration Tool.



Instructions are shown below:

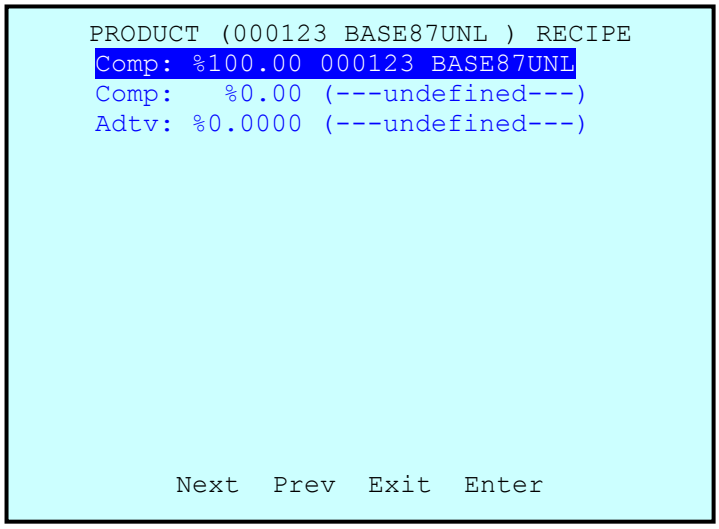
1. With **Code** highlighted, press **Enter**.
2. At the cursor, key in a product code for the base component. The code can be up to 6 digits.
3. After keying in the product code, press Enter.
4. Press **Next** to select **Long Desc**, press **Enter**.
5. At the cursor, key in a long description for the base component. The description can be up to 25 characters. This text will appear on the Preset Control screen and the Product Selection screen.
6. Fill in the remaining product definition parameters, as follows:

Short Desc	A short-hand description of the product. Maximum 10 characters.
Hazard Idx	The Hazard index code associated with this product. This code will reference the appropriate Hazard statements to print on meter tickets.
Type	The type of product. Choices are Base Component, Base Additive, and “undefined”. For this example, select Base Component.

7. Select Edit Product Recipe. The Product Recipe screen appears.

4.10.1 DEFINING BASE COMPONENT RECIPES

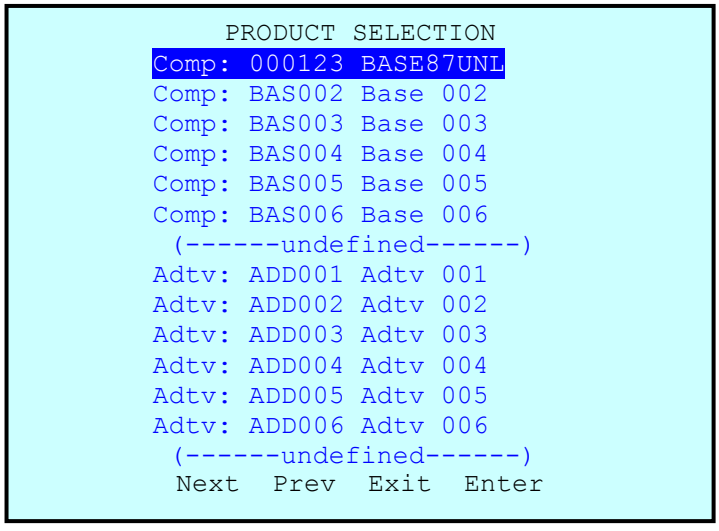
For both TMS and MultiLoad II, every base product component must be composed of 100% of itself. Therefore, the product recipe for a base component would look like this:



Note that the default percent is 100, indicating that this "product" is composed of 100% of itself.

Press **Exit** to return to the Edit Product screen.

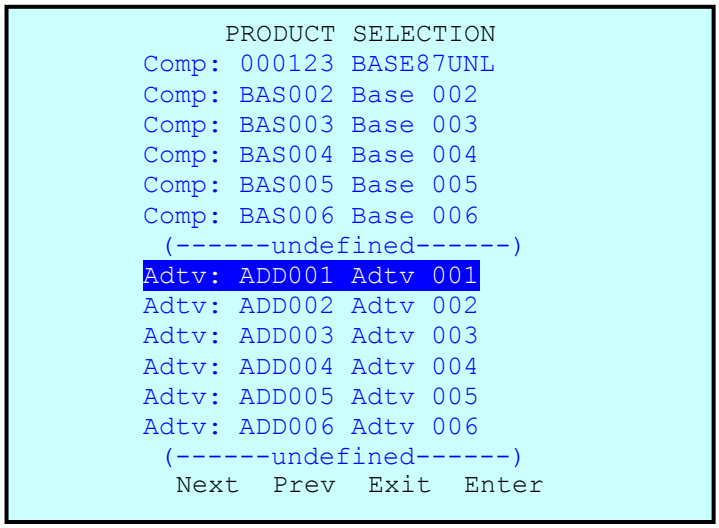
Press **Exit** to return to the Select Product screen, which displays the newly created base component, as shown below.



4.10.2 DEFINING AN ADDITIVE

Defining an additive is almost identical to defining a base component:

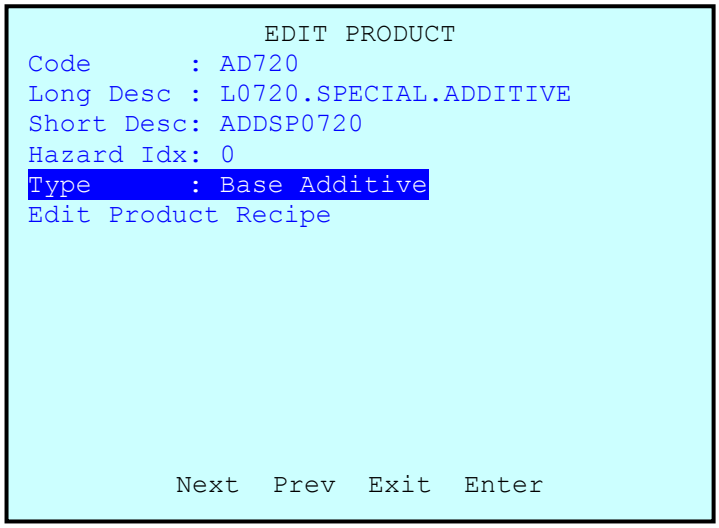
On the Product Selection screen, highlight the product to edit.



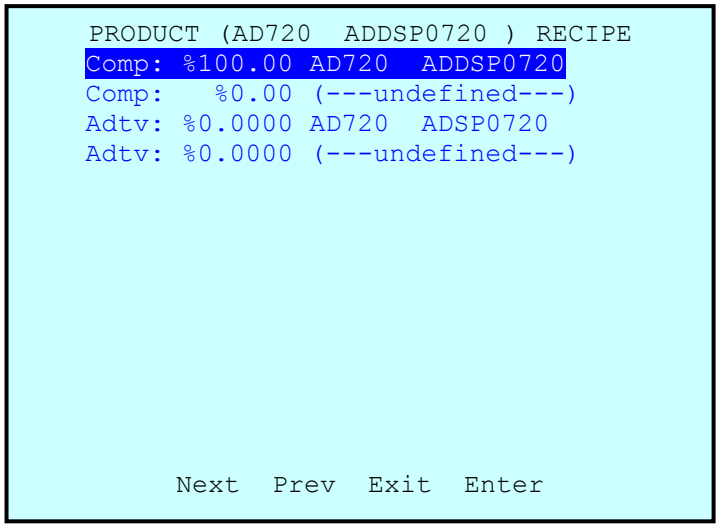
Press **Enter** will select the product to edit.

The Edit Product screen displays:

Fill in the fields as you did for the base component, but with one exception: For Type, select Base Additive, as shown in the sample below.

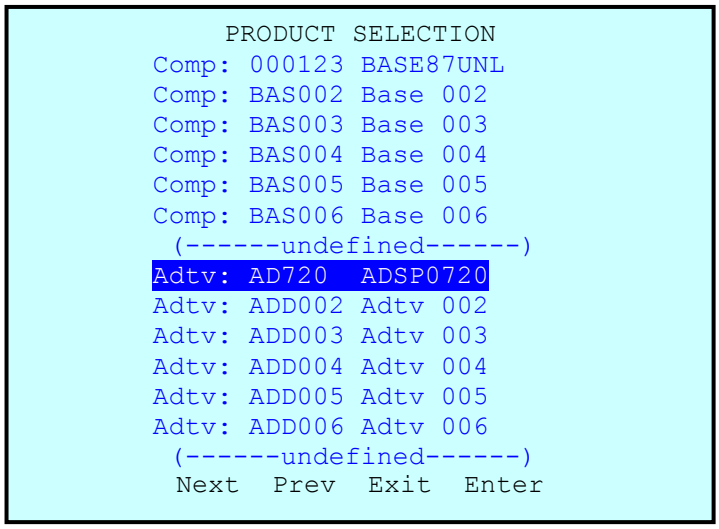


Select **Enter**. The base additive is defined automatically, and it is composed of %100 of itself. If you were to select Edit Product Recipe, the new base additive would be displayed on the Product Recipe screen, shown below. (Normally, however, there would be no need to go to the Product Recipe screen when establishing base additives and base product components.)



Select **Exit** to return to the Select Product screen.

Continue to define your base additives, as necessary.



4.11 DEFINING SALEABLE PRODUCTS

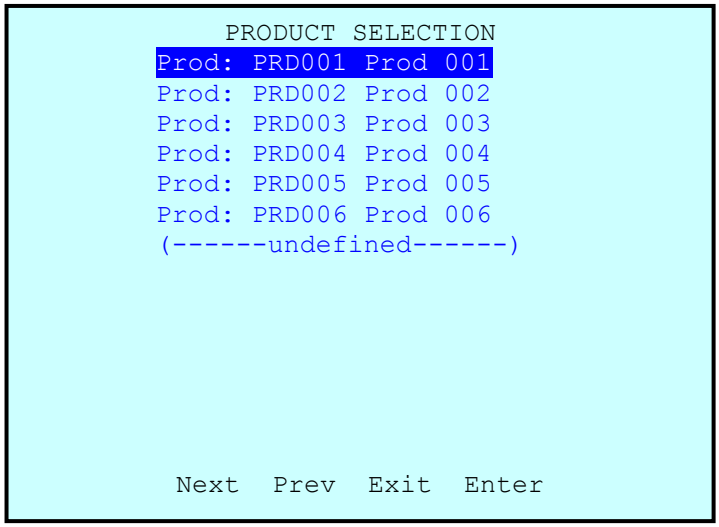
After defining the base components and base additives, begin defining saleable products. The system defines a single saleable product (Product) as composed of 1 to 8 base components and 0 to 6 additives. .

Up until this point, the Product Recipe screen has not been necessary, since each base component and additive is automatically defined as 100% of itself. For defining saleable products, however, the Product Recipe screen becomes central to product definition.

Defining a Single Saleable Product

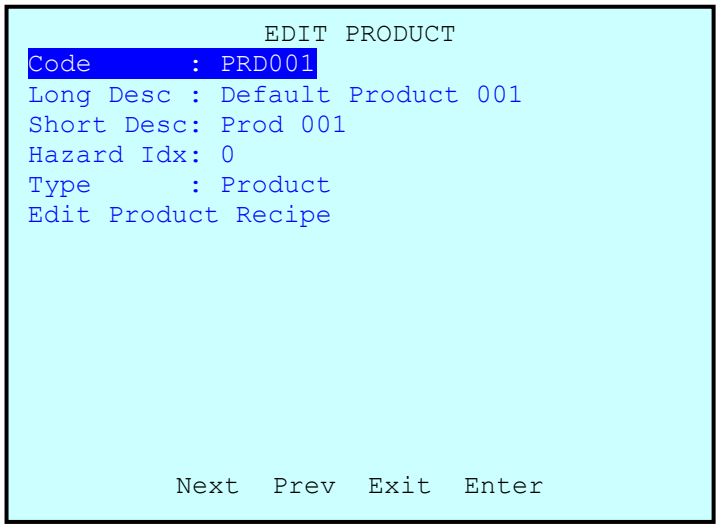
In the following sequence, a single saleable product is created, based on a single base component and a percentage of an additive.

On the Product Selection screen, highlight the product to edit.

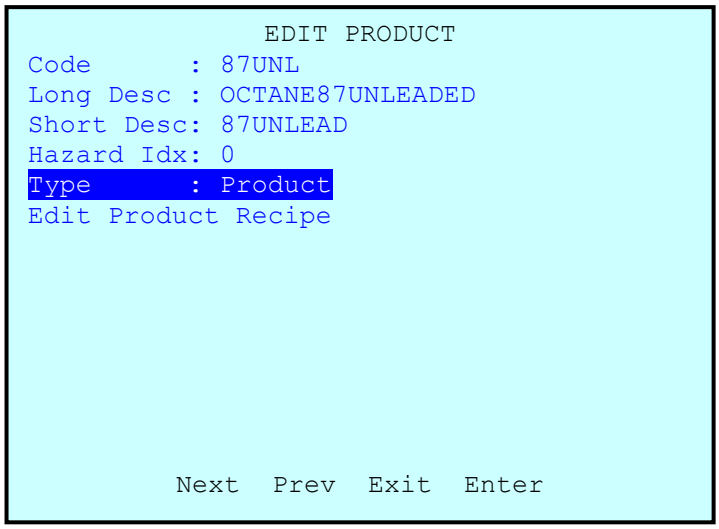


Press **Enter** will select the product to edit.

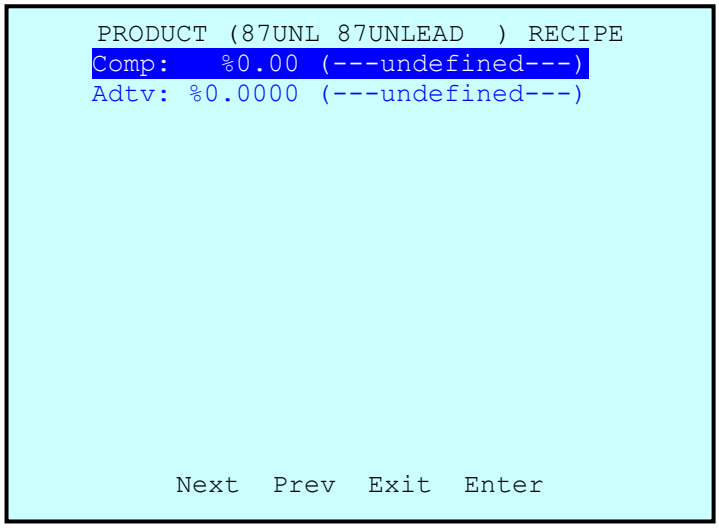
The Edit Product screen displays:



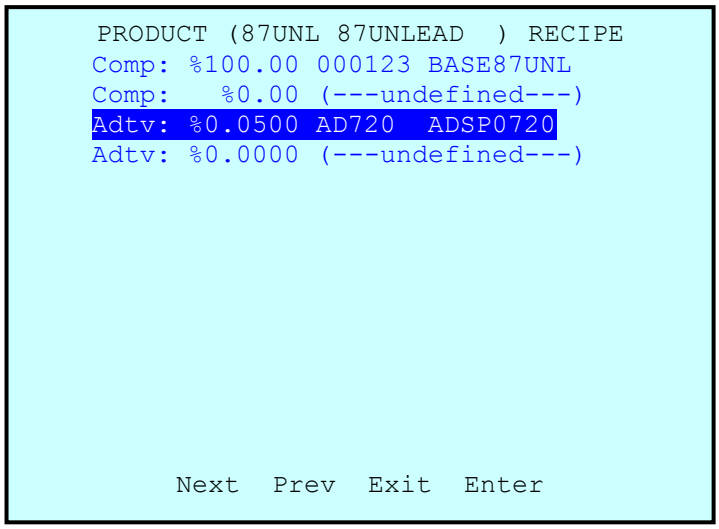
Fill in the fields and for Type select Product, as shown in the example below.



Select Edit Product Recipe.
The Product Recipe screen displays:



Configure the Base Component and Base Additive as shown in the example below.



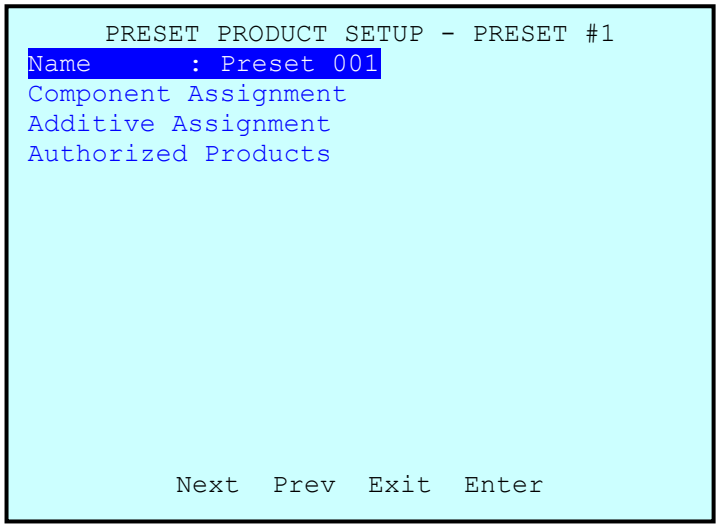
When done, press Exit twice to return to the Product Setup Menu.

4.12 PRESET PRODUCT SETUP

Use the Preset Product Setup functions to:

- Assign defined Base Components to a Component.
- Assign defined Base Additive to an Additive.
- Assign defined Saleable Products to a Preset

Navigate to this screen as: Program Mode -> Configuration -> Products -> Preset Product Setup
The Preset Product Setup screen displays:

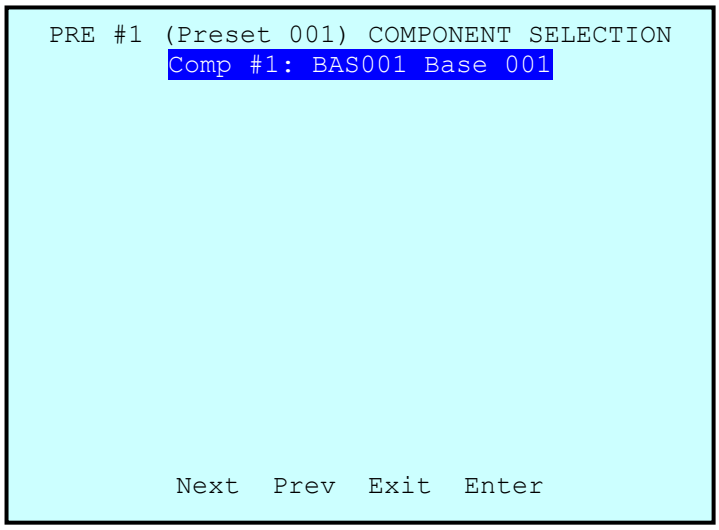


4.12.1 PRESET NAME

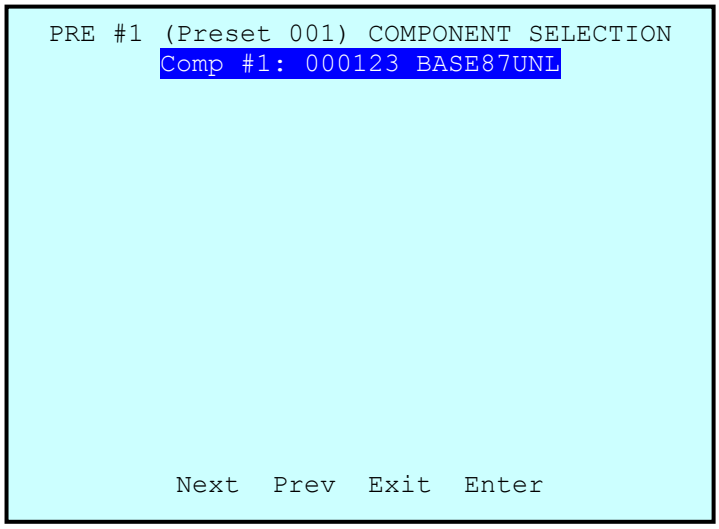
The Preset can be assigned a name. This is will be displayed before the driver makes a product selection.

4.12.2 COMPONENT ASSIGNMENT

After defining your base components, this function allows assignment to the physical component. When selected the Component Selection Screen is displayed:

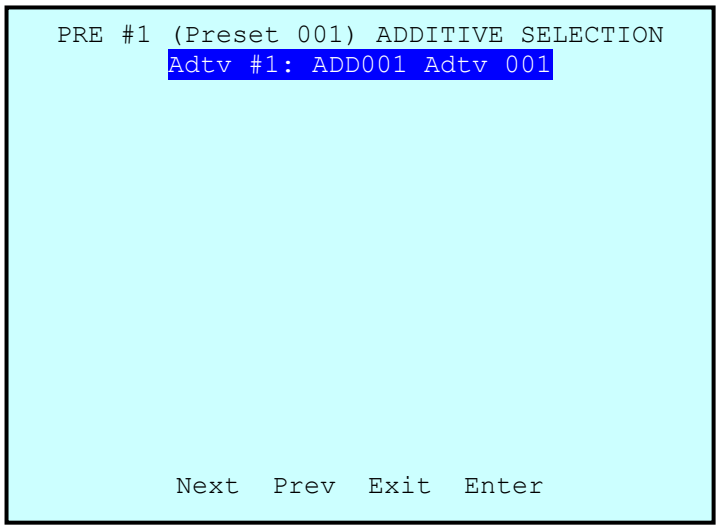


Configure the assigned Base Component as shown in the example below.

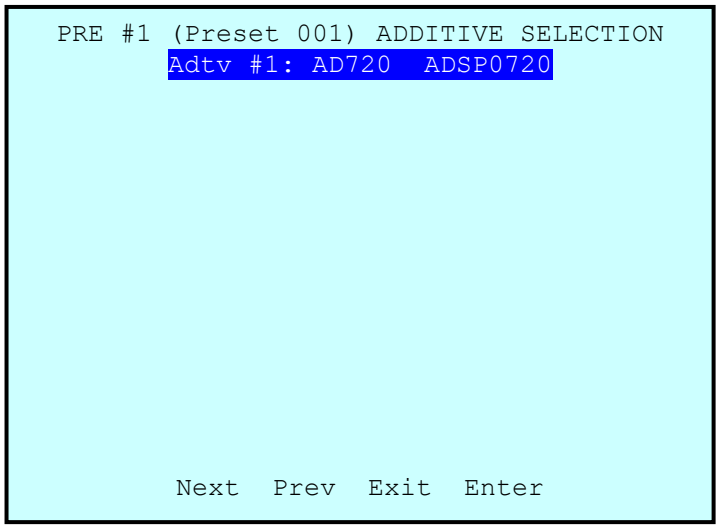


4.12.3 ADDITIVE ASSIGNMENT

After defining your base additives, this function allows assignment to the physical additive. When selected the Additive Selection Screen is displayed:



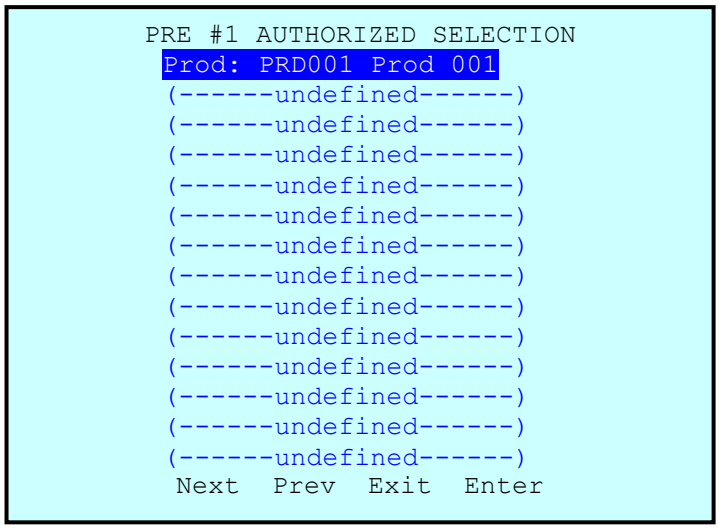
Configure the assigned Base Additive as shown in the example below.



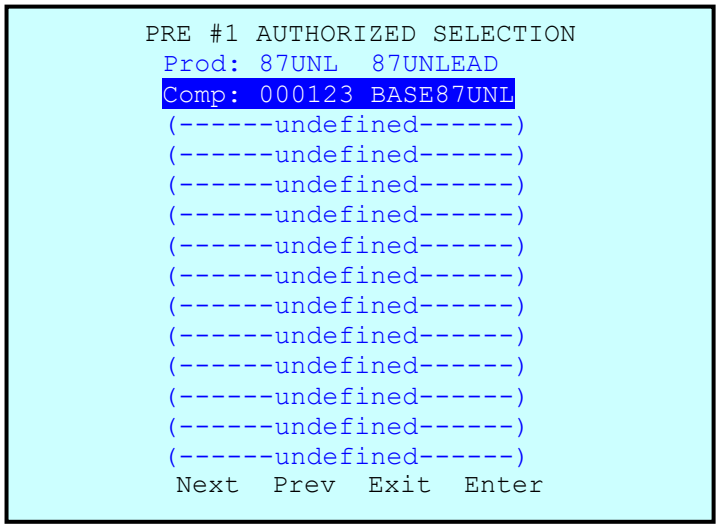
4.12.4 AUTHORIZED PRODUCTS ASSIGNMENT

After defining your saleable products, use this function is to specify which saleable products are authorized to be loaded at this preset.

When Authorized Products is selected the Authorized Products Screen is displayed:



Configure the authorized Salable Products as shown in the example below.

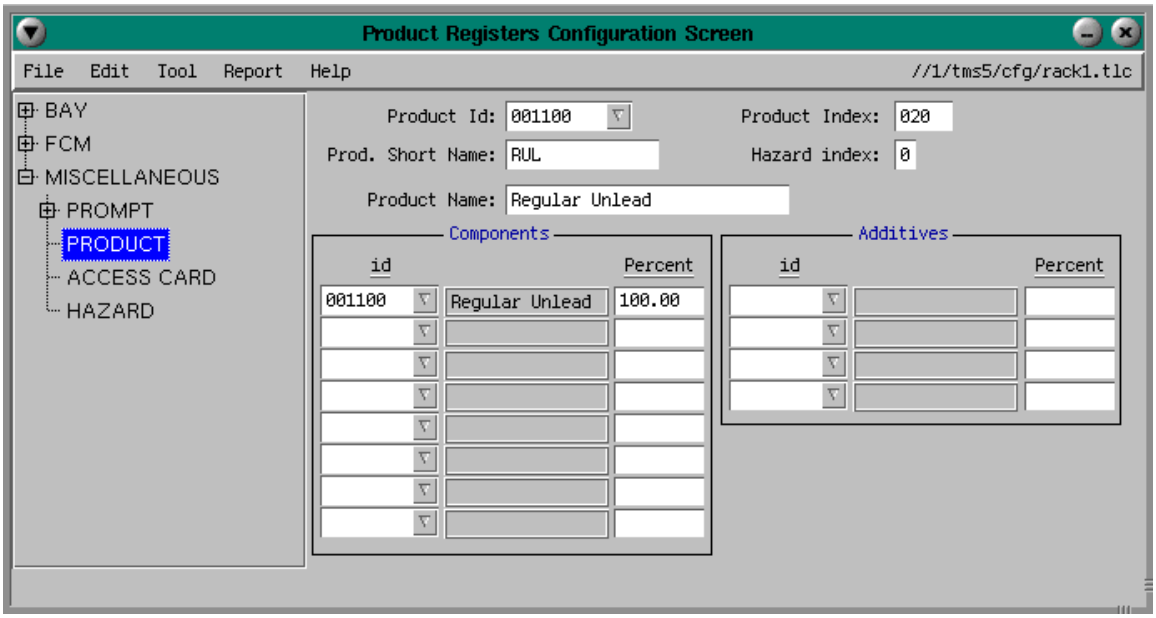


When more than one Saleable Product is defined, the Driver will be given a product selection screen during authorization.

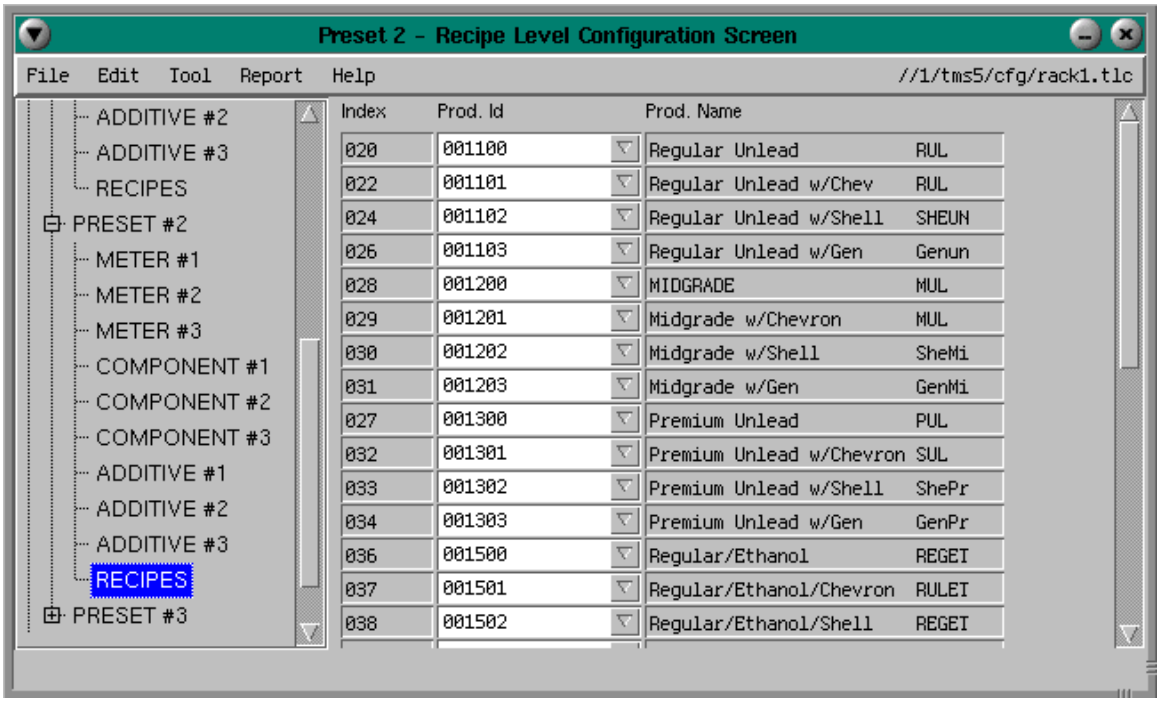
Note: Base components (Comp) can also be made available for loading, if desired.

4.12.5 CONFIGURATION TOOL PRODUCT REGISTER CONFIGURATION SCREEN

(See Local Product Definition and Assignment for information on this screen.)



4.12.6 CONFIGURATION TOOL RECIPE CONFIGURATION SCREEN

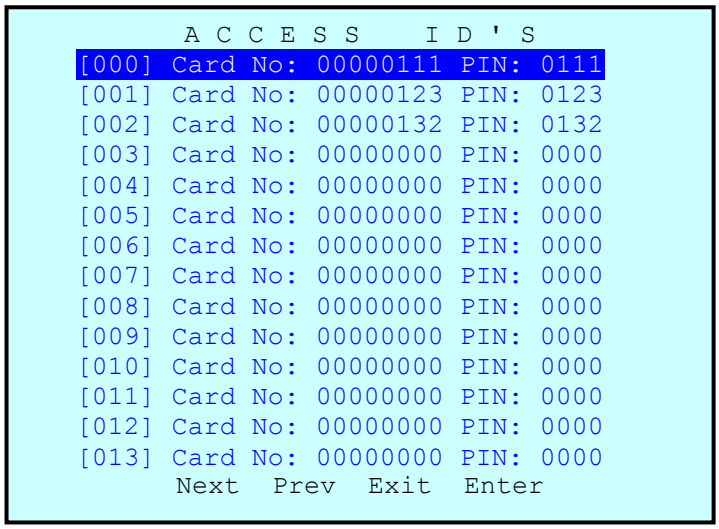


4.13 ACCESS IDS

Use the Access ID's function to assign Personal Identification Numbers (PINs) to MultiLoad II access cards. Up to 300 (0–299) Access IDs (cards) can be stored in the system along with the associated PIN number. Access number length may be from 4–8 characters long.

Navigate to this screen as: Program Mode -> Configuration -> Access ID's

The Access ID's Setup screen displays:



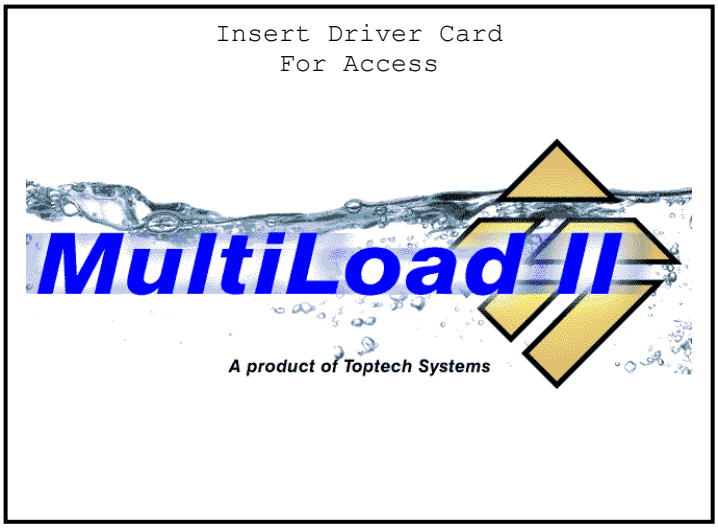
For each card, press **Enter**, then key in the card number using the keypad. Press **enter** then key in the corresponding Pin number. Press **Enter** again to save. Then press **Next** to select the next line and repeat the above.

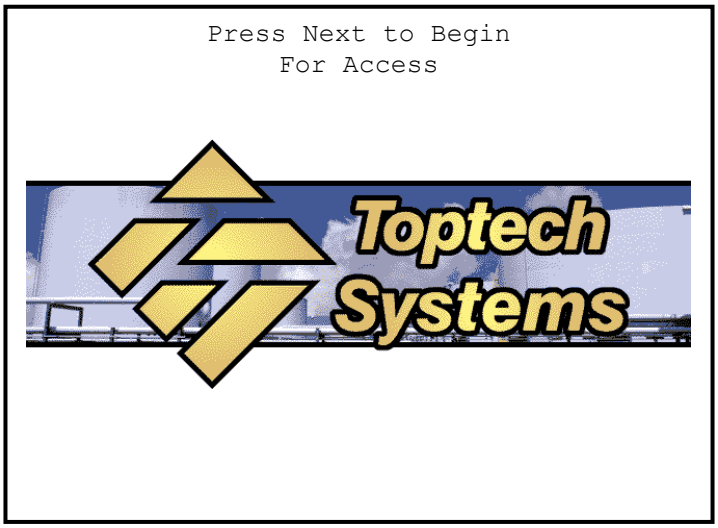
When you complete the last card on the first screen, press **Next** to continue on the next screen.

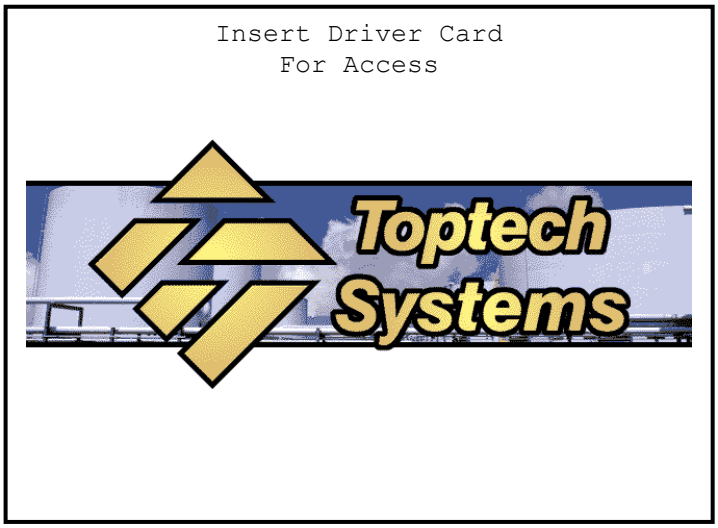
Notice that the selection bar is on the last line of the continuation screen ([013]). Press **Next** to move the selection bar to the top of the screen to continue with the next card in sequence ([014]).

4.14 CUSTOMER LOGO SETUP

When the MultiLoad II is idle (not authorized for loading), the screen displays a message instructing the driver how to begin the authorization process.





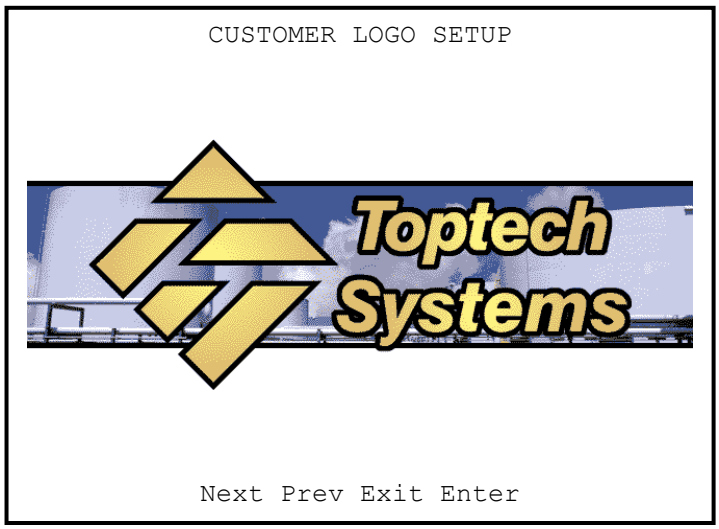


The display also alternates between three graphic images, 2 Product Identification Images, and a configurable customer logo (default customer logo is the “Toptech Systems” graphic.

There are two methods to configure this customer logo: Load from a built in customer logo or upload a custom .bmp file.

4.14.1 LOADING A BUILT IN CUSTOMER LOGO

Enter Program Mode, select Configuration, and then Customer Logo Setup. The Customer Logo Setup screen is displayed.



The currently loaded customer logo is displayed.

Pressing the Next and Prev keys will allow viewing of all built in logos.

Pressing Exit will return to the Configuration Menu without changing the currently loaded customer logo.

Pressing Enter will load the currently displayed customer logo.

4.14.2 UPLOADING A CUSTOM .BMP CUSTOMER LOGO

The .BMP file containing the customer logo must conform to certain specifications for the upload to be successful. Those specifications are:

- BMP (Bitmap) format.
- 4 bits per pixel (16 color depth)
- Height MUST be 240 pixels.
- Uncompressed image data.
- Width MUST be 640 pixels.
- No more than 6 custom colors. That is Colors (R, G, B) other than:

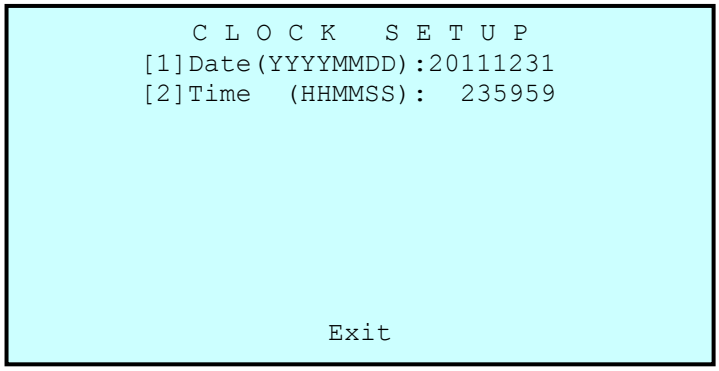
BLACK (0, 0, 0)	BLUE (0, 0, 255)
RED (255, 0, 0)	MAGENTA (255, 0, 255)
GREEN (0, 255, 0)	CYAN (0, 255, 255)
YELLOW (255, 255, 0)	WHITE (255, 255, 255)

TMS 5 and TMS 6 have a utility program to upload a .BMP file conforming to these specifications into a MultiLoad II. For standalone MultiLoad II and RCU II applications, use the latest MultiMate configuration tool to upload a customer logo. On Rev 2.0 CPU boards, the SD-Card slot can also be used to upload a logo BMP file.

4.15 SYSTEM DATE AND TIME

Use the Date & Time function to set the current date and time.

1. From the Configuration menu, choose **Date & Time.** The CLOCK SETUP screen displays:



2. Press **1** and enter the current date in YYYYMMDD format. For example, enter April 8, 2003 as **030408**. Press **ENTER** to save the entry.
3. Press **2** and enter the current time in HHMMSS (hours, minutes, seconds) 24-hour format. For example, for 15 seconds past 2:30 pm, enter **143015**. Press **ENTER** to save.

Changes to the Date and Time parameters are logged in the W&M Change Log.

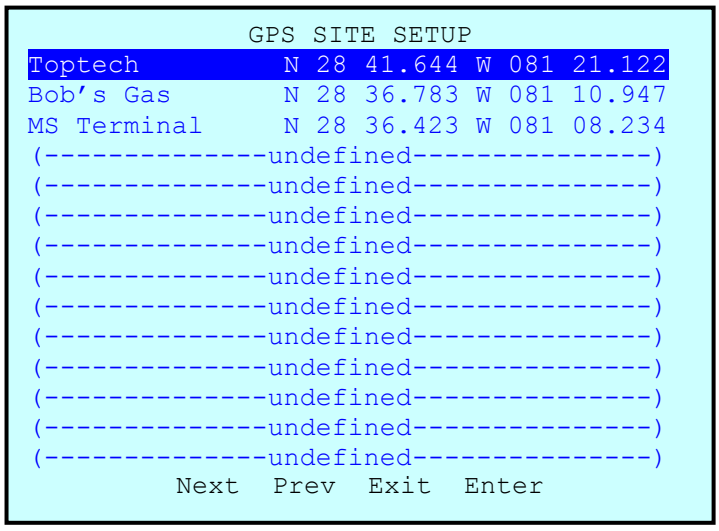
4.16 GPS SITES (ML II MOBILE ONLY)

Use the GPS Site Setup function to enter up to 4,000 approved transaction sites. Each site name can be up to 15 characters. A GPS must be connected and configured to use this option. This database can use to:

- Display the current site name on the card in display.
- Record the Latitude, Longitude and Site Name into the local transaction database header.
- Optionally raise a GPS error if the transaction authorization is not at a site in the database.
- Raise a GPS error is the position changes after transaction authorization.

Navigate to this screen as: Program Mode -> Configuration -> GPS Sites

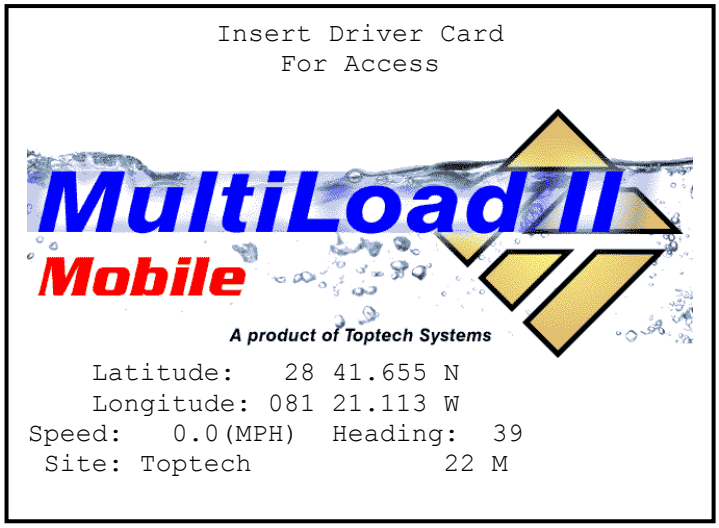
The GPS Site Setup screen displays:



For each Site, press **Enter**, then key in the Site Name using the keypad. Press **enter** then key in the corresponding Latitude and Longitude values. Press **Enter** again to save. Then press **Next** to select the next line and repeat the above.

When you complete the site on the first screen, press **next** to continue on the next screen.

The card in display displays:



CHAPTER 5 PRODUCT FLOW CONTROL

5.1 OVERVIEW

This Chapter focuses on flow control configuration; it discusses the concepts and procedures relevant to effective product flow control

- Single-Component Product Delivery
- Calibration Using Meter Factor Linearization

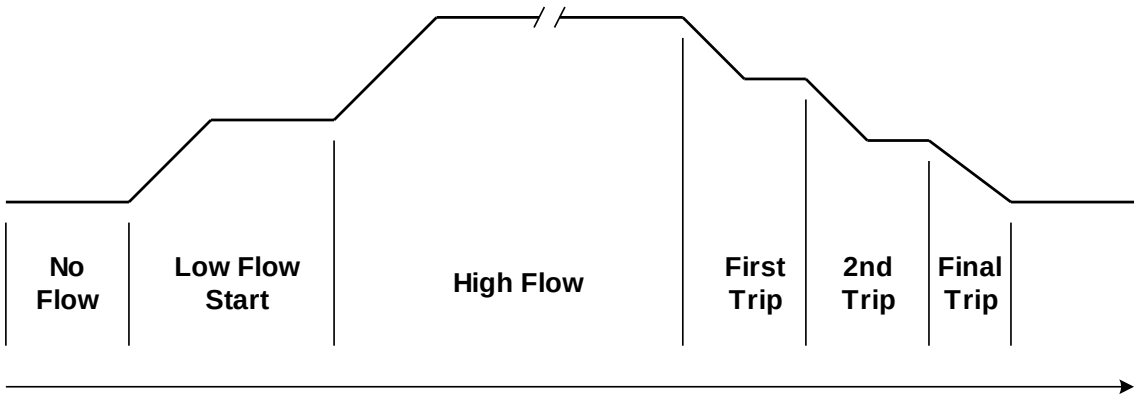


Figure 5.1 Flow Profile

5.2 SINGLE PRODUCT DELIVERY

The following discussion pertains to a load arm that loads a single component. There are five stages that occur while product is flowing.

- Low Flow Start
- High Flow
- 1st Stage Trip
- 2nd Stage Trip
- Final Trip

The digital control valve is the key component of the meter run. The MultiLoad II makes adjustments to the valve based on feedback from the flow meter. The flow profile illustrated below shows how each stage progresses throughout a load.

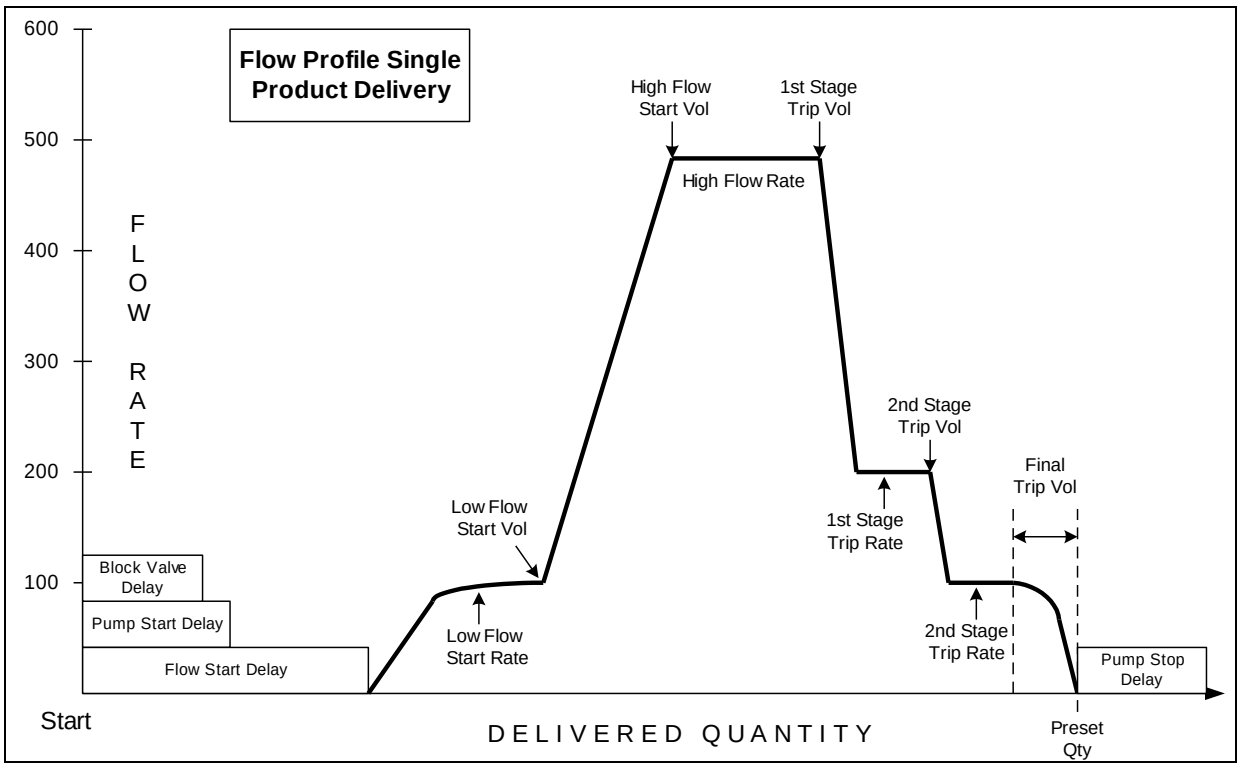


Figure 5.2 Flow Profile for Single Product Delivery

The load begins in the Low Flow Start stage. When the Start button is pressed, the control valve opens and the flow rate ramps up from zero to the Low Flow Rate. Both the normally open (Upstream) and normally closed (Downstream) solenoids of the digital control valve are energized, causing the control valve to open. If sufficient pressure is available, the Low Flow rate should be achieved in seconds. When the flow rate rises to within the Low Flow Dead Band Rate, the normally closed (Downstream) solenoid of the control valve will de-energize. This action locks the valve in position in order to maintain the desired rate.

The opening of the control valve can be delayed by the Flow Start Delay parameter perhaps to allow time for the pump pressure to build to a suitable level.

The starting of the pump can be delayed by the Pump Start Delay parameter perhaps to allow time for the block values to fully open/close.

These parameters are located in the Component Setup screen.

Once the Low Flow rate has been achieved, the MultiLoad II will make periodic adjustments to the valve as the flow rate drifts above or below the Low Flow Dead Band rate. Dead Band rates are configured on the Meter Setup screen. The duration of the Low Flow stage is set by the Low Flow Start Volume parameter. This parameter can be found on the Preset Setup screen. As the parameter name implies, the duration of the Low Flow Start stage is determined on a volumetric basis. The Low Flow Start Volume should be configured to permit adequate tank wetting in order to prevent a static charge build-up. When the Low Flow Start Volume has been delivered, the High Flow stage will begin.

Whenever a load is momentarily stopped before completion and then restarted, the Low Flow Restart stage will commence. If a load is restarted in the midst of the High Flow cycle, a low flow rate will be used initially and for a shorter duration than is typical of Low Flow Start.

The following table lists the parameters that affect the start of loading and the Low Flow Start characteristics.

Parameter	Default Setting	Screen Location
Low Flow Start Volume	50 gallons	Preset Setup
Low Flow Rate	150 gallons per minute	Preset Setup
Low Flow DB Rate	+/- 40 gallons per minute	Meter Setup
Low Flow Alarm Rate	10 gallons per minute	Meter Setup
Low Flow Alarm Time	10 seconds	Meter Setup
Flow Start Delay	5 seconds	Component Setup
Pump Start Delay	3 seconds	Component Setup
Low Flow Restart Volume	15 gallons	Preset Setup

For detailed parameter descriptions, please refer to the appropriate section in Chapter 4 – General Configuration.

5.2.1 HIGH FLOW

As the High Flow stage begins, the MultiLoad II energizes both of the digital control valve's solenoids. This permits the line pressure to increase the valve's open area. Once the High Flow rate is achieved, the normally closed (downstream) solenoid will be de-energized. This is done in an attempt to lock the valve in a position to maintain the desired flow rate. Periodic adjustments are made to the valve as the flow rate drifts above or below the High Flow Dead Band rate. Dead Band rates are configured in the Meter menu. Product flow will continue at the High Flow rate until the 1st Stage Trip Volume is reached. The following is a table of parameters that affect the High Flow stage characteristics.

Parameter	Default Setting	Screen Location
High Flow Rate*	600 gallons per minute	Preset Setup
High Flow DB Rate	+/- 40 gallons per minute	Meter Setup
Excess Flow Alarm Rate	800 gallons per minute	Meter Setup

5.2.2 1ST STAGE TRIP

The 1st Stage Trip phase begins when the remaining volume reaches the volume indicated by the 1st Stage Trip Volume parameter, located on the Component Setup screen. This phase is the initial transition when approaching target delivery. When the 1st Stage Trip Volume is reached, the MultiLoad II de-energizes both solenoids, which permits the line pressure to reduce the valve opening. The solenoids will remain de-energized until the 1st Stage Flow Rate is reached. The 1st Stage Flow Rate is configured in the Component menu.

When the 1st Stage Trip flow rate is achieved, the MultiLoad II will energize the normally open (upstream) solenoid. This is done in an attempt to lock the valve in a position to maintain the desired flow rate. Periodic adjustments to the valve are made as the flow rate drifts above or below the 1st Stage Trip Dead Band rate. Product flow will continue at the 1st Stage Trip flow rate until the 2nd Stage Trip Volume is reached.

Parameter	Default Setting	Screen Location
1st Stage Flow Rate*	225 gallons per minute	Component Setup
1st Stage Trip Volume*	70 gallons	Component Setup
1st Stage DB Rate	+/- 40 gallons per minute	Meter Setup

5.2.3 2ND STAGE TRIP

The 2nd Stage Trip phase will begin when the remaining volume reaches the volume indicated by the 2nd Stage Trip Volume parameter. This parameter is in the Component menu. This phase is the second in a series of adjustments from the High Flow rate to a no flow condition. When the 2nd Stage Trip Volume is reached, MultiLoad II will de-energize both solenoids; this permits the line pressure to reduce the valve opening. The solenoids will remain de-energized until the 2nd Stage Flow Rate is reached. The 2nd Stage Flow Rate is configured in the Component menu.

When the 2nd Stage Trip flow rate is achieved, the MultiLoad II will energize the normally open (upstream) solenoid. This is done in an attempt to lock the valve in a position to maintain the desired flow rate. Periodic adjustments to the valve will be made as the flow rate drifts above or below the 2nd Stage Trip Dead Band rate. Product flow will continue at the 2nd Stage Trip flow rate until the 'Final Trip Volume' is reached. The 2nd Stage Trip phase ends when the 'Final Trip Volume' has been reached.

Parameter	Default Setting	Screen Location
2nd Stage Flow Rate	150 gallons per minute	Component Setup
2nd Stage Trip Volume	20 gallons	Component Setup
2nd Stage DB Rate	+/- 40 gallons per minute	Meter Setup

5.2.4 FINAL TRIP

The Final Trip Stage is the last phase of delivery where product flow is authorized. When the time specified in the Final Trip Max Time parameter has elapsed, flow must be completely stopped. When the Final Trip Max Time expires, the preset will transition to the Idle state. If flow is still detected past this period, and if the Overrun Alarm Volume has been exceeded, the Overrun Alarm will activate. The 'Final Trip Volume' parameter will command the valve to close prior to reaching the preset quantity to compensate for small, consistent over deliveries. This adjustment is made on a volumetric basis. For example, if the valve consistently delivers 1.50 volumetric units more than the preset amount, enter **1.50** for this parameter. The Final Trip parameters are located on the Component Setup screen.

Parameter	Default Setting	Screen Location
Final Trip Volume	1.15 gallons	Component Setup
Final Trip Maximum Time	500 milliseconds	Component Setup
Overrun Alarm Volume	20 gallons	Preset Setup

5.2.5 2"-3" DIGITAL CONTROL VALVES

Once the digital control valve, needle valve adjustments are correctly set, digital valve control is not a problem. But with small 2"-3" digital valves or valves that do not contain needle valve adjusters, these valves tend to react very quickly to and sometimes result in constant overshooting of the target flow rate, especially at low flow rates. This can be observed as the valve fails to lock into a steady flow rate while the solenoids continue to click throughout the load.

To prevent this problem an alternative flow algorithm can be configured. This algorithm makes small steps in the adjustment of the digital control valve eliminating the overshoot and allowing a reduction in the flow deadband values. Changing the length of time the solenoid is strobed (Valve Dwell Time) will allow software adjustment of the valve speed similar to the way a needle valve adjusts the valve speed.

MultiLoad can be configured to use this alternate digital control valve algorithm by configuring as follows:

Navigate to: Program Mode->Configuration->Equipment Setup and configure the following parameters:

Parameter	Setting	Screen Location

Flow Scan Time	0.200 Seconds	Meter Setup
Valve Dwell Time	0.060 Seconds	Meter Setup

To increase the speed of adjustment, increase the Valve Dwell Time by 0.005 up to no more than 0.170 seconds.

To decrease the speed of adjustment, decrease the Valve Dwell Time by 0.005 down to no less than 0.030 seconds.

5.2.6 ADAPTIVE DIGITAL CONTROL ALGORITHM

To increase the accuracy of targeting flow rates, an Adaptive Digital Control Valve Algorithm have been developed. This algorithm notes the adjustment speed of the digital control valve with the current flow and valve conditions, and adjusts its control method to target as close as possible to the target flow rate. Once locked into this target flow rate the next adjustment will not occur until the current flow rate falls outside the target deadband.

With FCM or I/O Board versions 037 and later, MultiLoad can be configured to use this Adaptive Digital Control Valve Algorithm by configuring as follows:

Navigate to: Program Mode->Configuration->Equipment Setup and configure the following parameters:

Parameter	**Setting**	**Screen Location**
Flow Scan Time	0.200 Seconds	Meter Setup
Adaptive Valve Control	ENABLED	Meter Setup

5.2.7 TWO STAGE VALVES

Two stage valves are similar to Digital control valves in that they both operate using Normally Open (NO) and Normally Closed (NC) solenoids. The two stage valve provides only two flow rates however. Low and High.

MultiLoad can handle two stage valves through proper configuration as follows:

Navigate to: Program Mode->Configuration->Equipment Setup and configure the following parameters:

Preset	Meters	Components
Low Flow Rate: 5000	Low Flow DB Rate: 4999	High Flow Rate: 9999
High Flow Rate: 9999	1st Stage DB Rate: 4999	1st Stage Flow Rate: 5000
	Excess Flw Alrm Rate: > Max anticipated flow rate	2nd Stage Trip Vol: 0 Fallback Time: 0

5.2.8 ANALOG VALVES

Analog valves are control valves that operate from a 4-20mA signal that indicates the proportional opening of the valve.

An analog signal of less than or equal to 4mA will drive the valve completely closed (0%).

An analog signal of greater than or equal to 20mA will drive the valve completely open (100%).

An analog signal between 4mA and 20mA will drive the valve to a percent open between 0% and 100%.

An analog valve by itself does not target a flow rate, so the valve control signal will be adjusted by MultiLoad to target a flow rate profile.

With FCM or I/O Board versions 037 and later, MultiLoad can handle analog valves through proper configuration as follows:

Navigate to: Program Mode->Configuration->Equipment Setup and configure the following parameters:

Parameter	Setting	Screen Location
Flow Scan Time	0.200 Seconds	Meter Setup
Analog Valve Control	ENABLED	Meter Setup
4-20mA Increase Step	0.080 mA	Meter Setup
4-20mA Decrease Step	0.800 mA	Meter Setup

To change the speed of positive flow changes, modify the 4-20mA Increase Step.

To change the speed of negative flow changes, modify the 4-20mA Decrease Step.

5.3 SEQUENTIAL BLENDING (EXCLUDING SMP)

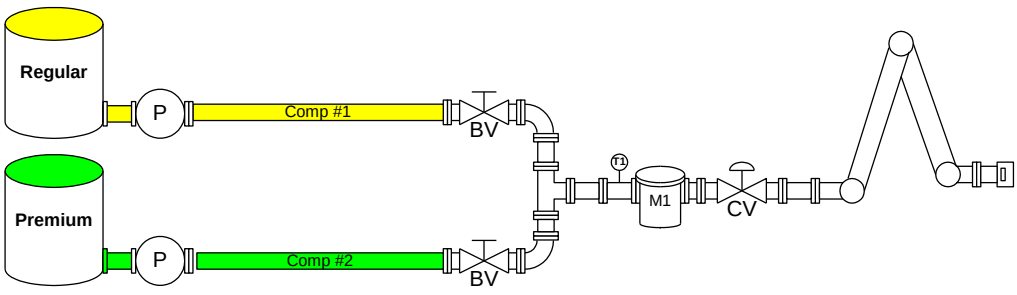


Figure 5.3 Sequential Blending Application

The Sequential Blending feature is used when loading two to eight (2 – 8) components together in a compartment to make a single product. Typically the components will be delivered one at a time through the same load arm, using one flow meter and one digital control valve.

Block valves, which serve as component selection valves, must be used to ensure loading of the proper component in the proper sequence. These valves can be motor operated (MOV) or they can be manually operated. In either case, a block valve status or feedback signal can be employed to verify that the valves are in the proper position at all times during the loading sequence.

The flow profile control sequence used in Sequential Blending is very similar to the sequence used for single product loading. The sequence is repeated for each component that is used in the product recipe. The first component of the blend will cycle through the following phases:

- Low Flow Start
- High Flow

- 1st Stage Trip
- 2nd Stage Trip
- Final Trip

The load begins in the Low Flow Start stage. When the Start button is pressed, the control valve opens and the flow rate ramps up from zero to the Low Flow Start flow rate. Both the normally open (NO) and normally closed (NC) solenoids of the digital control valve are energized, causing the control valve to open. If sufficient pressure is available, the Low Flow rate should be achieved in seconds. When the flow rate rises to within the Low Flow Dead Band Rate, the normally closed (NC) solenoid of the control valve will de-energize; this action locks the valve in position in order to maintain the desired flow rate.

The initial opening of the control valve can be delayed by the Pump Start Delay parameter and/or the Flow Start Delay parameter. The optional Pump Start Delay may be used to allow time for the pump pressure to build to a suitable level. The control valve will open immediately after the Pump Start Delay time has expired, if the Flow Start Delay parameter is set to zero. Otherwise, the control valve opening will be further delayed by the time period specified by the Flow Start Delay parameter. These parameters are located in the Component menu.

Once the Low Flow rate has been achieved, the Flow Control Module will make periodic adjustments to the valve as the flow rate drifts above or below the Low Flow Dead Band rate. Dead Band rates are configured in the Meter menu. The duration of the Low Flow stage is set by the Low Flow Start Volume parameter. This parameter can be found in the Preset menu. As the parameter name implies, the Low Flow Start stage's duration is determined on a volumetric basis. The Low Flow Start Volume should be configured to permit adequate tank wetting in order to prevent a static charge build-up. When the Low Flow Start Volume has been delivered, the High Flow stage will begin.

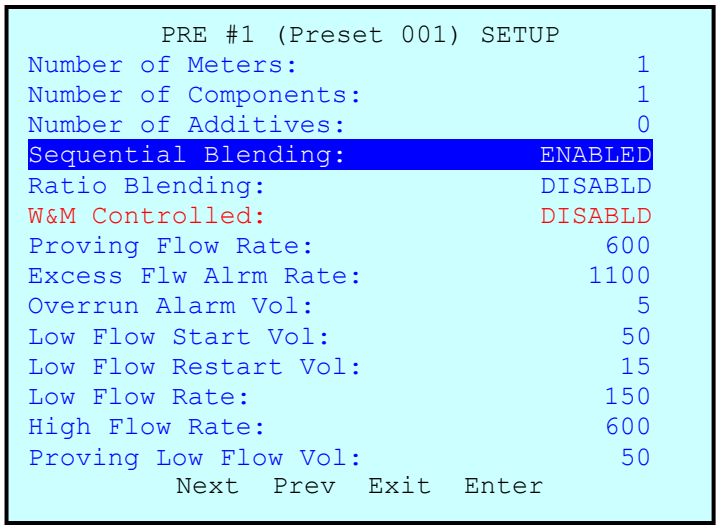
When subsequent components are started, the tank has already been wetted. As a result, it is not necessary to stay at the Low Flow Start flow rate for the same duration as the first component. The components that follow the first component will begin loading at the Low Flow Start flow rate until the volume specified by the Low Flow Restart parameter has been delivered. Product flow of the subsequent components can be delayed by the Pump Start Delay parameter and by the Flow Start Delay parameter as described for the first component. These parameters will have to be configured individually for each component assigned to the preset (load arm).

5.3.1 SEQUENTIAL BLENDING CONFIGURATION

Configuring a preset/load arm for sequential blending involves setting a number of configuration parameters at the Preset, Meter and Component levels.

Preset Setup

Configure the preset or the load arm for sequential blending by indicating the number of flow meters that will be assigned to the preset. Typically for sequential blenders, one flow meter and control valve are used. Up to five meters can be used if desired. It is assumed that if more than one meter is used, there will be multiple, independent meter runs, with each meter having its own control valve.


PRE #1 (Preset 001) SETUP
Number of Meters: 1
Number of Components: 1
Number of Additives: 0
Sequential Blending: ENABLED
Ratio Blending: DISABLD
W&M Controlled: DISABLD
Proving Flow Rate: 600
Excess Flw Alrm Rate: 1100
Overrun Alarm Vol: 5
Low Flow Start Vol: 50
Low Flow Restart Vol: 15
Low Flow Rate: 150
High Flow Rate: 600
Proving Low Flow Vol: 50
Next Prev Exit Enter

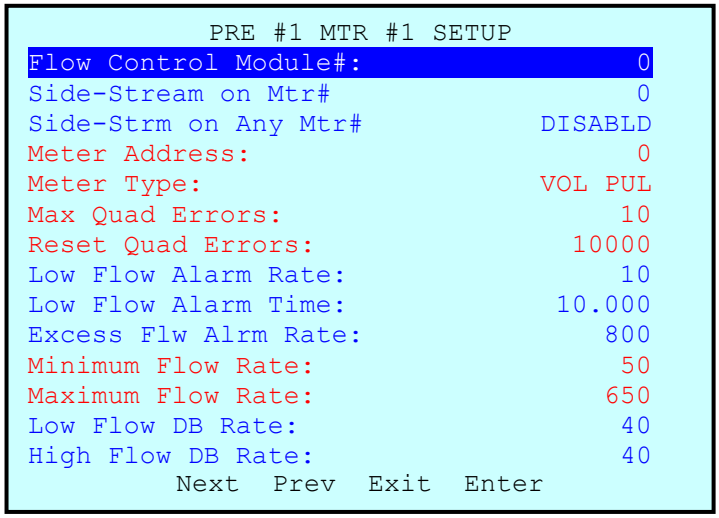
After establishing the number of flow meters assigned to the preset, indicate the number of components that will be delivered through the load arm. Enable the Sequential Blending parameter. For multiple meter runs, the Ratio Blending parameter may also be enabled if some recipes will be using ratio delivery.

Low Flow and High Flow rates are established in the Weights & Measures/Preset menu. The Low Flow Start and Low Flow Restart volumes are also specified on this screen. These parameters define the flow profile.

Parameter	Default Setting
Low Flow Start Volume	50 gallons
Low Flow Restart Volume	15 gallons
Low Flow Rate	150 gallons per minute
High Flow Rate	600 gallons per minute

Meter Setup

The next phase of sequential blending configuration occurs at the Meter level on the Meter setup screen.


PRE #1 MTR #1 SETUP
Flow Control Module#: 0
Side-Stream on Mtr# 0
Side-Strm on Any Mtr# DISABLD
Meter Address: 0
Meter Type: VOL PUL
Max Quad Errors: 10
Reset Quad Errors: 10000
Low Flow Alarm Rate: 10
Low Flow Alarm Time: 10.000
Excess Flw Alrm Rate: 800
Minimum Flow Rate: 50
Maximum Flow Rate: 650
Low Flow DB Rate: 40
High Flow DB Rate: 40
Next Prev Exit Enter

Enter the Flow Control Module number that will receive the flow meter input. Valid choices are 0-31. The number of a FCM is determined by the communication address of the module. The address is determined by the setting of the DIP switch (S1) that is located on the FCM. The switch position indicates a binary zero when it is in the Off position; a binary one is represented by a switch in the On position.

The A channel of the flow meter signal will always be on Port 4 of the selected Flow Control Module. If a channel B signal is used for pulse security that input will always be connected to Port 5. If channel B is not used, Port 5 can be assigned to some other I/O function. Port 2 will automatically be assigned to be the control valve's NO Solenoid signal. Port 3 will be used for the control valve's NC Solenoid signal.

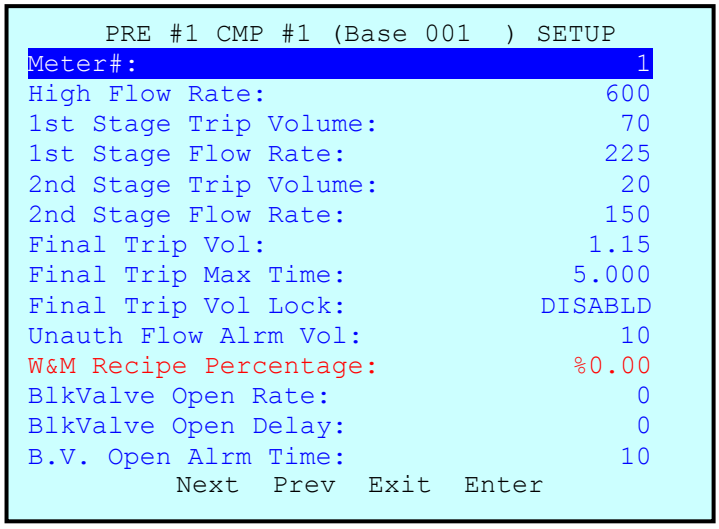
The Dead Band rates for the flow stages are configured on this screen. No Valve adjustments will be attempted when the flow rate is within the dead band. Whenever flow drifts outside of the dead band, the valve will make adjustments to bring the flow rate back within the dead band.

If multiple meters are assigned to the preset, repeat this process for the other meters.

Parameter	Default Setting
Flow Control Module #	0
1st Stage Dead Band Rate	40 gallons per minute
2nd Stage Dead Band Rate	40 gallons per minute

Component Setup

Component parameters related to Sequential Blending are found on the Component Setup screen, shown here. Scroll down the screen to view additional parameter fields.


PRE #1 CMP #1 (Base 001) SETUP
Meter#: 1
High Flow Rate: 600
1st Stage Trip Volume: 70
1st Stage Flow Rate: 225
2nd Stage Trip Volume: 20
2nd Stage Flow Rate: 150
Final Trip Vol: 1.15
Final Trip Max Time: 5.000
Final Trip Vol Lock: DISABLD
Unauth Flow Alrm Vol: 10
W&M Recipe Percentage: %0.00
BlkValve Open Rate: 0
BlkValve Open Delay: 0
B.V. Open Alrm Time: 10
Next Prev Exit Enter

Configure component #1. Assign the component to Meter #1. Typically, one flow meter is used for sequential blenders. If more than one meter is assigned to the blender, assign the component to the appropriate Meter #.

Assign the output that will signal the Block Valve to open. If applicable, assign an output signal to force the block valve to close. An optional Block Valve Status signal can be configured. Assign an input point to receive the feedback signal. The block valve input and output signals can be assigned to any available port. For FCM I, ensure that the Opto module is appropriate for the type of voltage that will be used.

Block valve open and closing alarm times can be configured. If the Block Valve Status signal is not received in the specified time, block valve alarm will be raised and the load will be stopped.

The Pump Start port assignment for the component is configured on this screen. Additionally, there is a Pump Kill output that can be assigned to provide a signal to remove power from the pump. An option also exists to configure a Pump Status signal to provide positive verification that a pump is running. The pump related input and output signals can be assigned to any Flow Control Module.

The 1st Stage Trip and the 2nd Stage Trip parameters are defined on the W&M Setup Screen. Enter the volume and rate that defines 1st Stage Trip and 2nd Stage Trips.

If more than one component is assigned to the preset, repeat this procedure for the other components.

Parameter	Default Setting
Meter #	1
1st Stage Trip Volume	70 gallons
1st Stage Trip Flow Rate	225 gallons per minute
2nd Stage Trip Volume	20 gallons
2nd Stage Trip Flow Rate	150 gallons per minute
Pump Run FCM#	Disabled
Pump Kill FCM#	Disabled
Pump Status FCM#	Disabled
Block Valve Open FCM#	Disabled
Block Valve Close FCM#	Disabled
Block Valve Status FCM#	Disabled

For detailed parameter descriptions, please refer to *General Configuration* chapter topic "Component Setup."

5.4 RATIO BLENDING (EXCLUDING SMP)

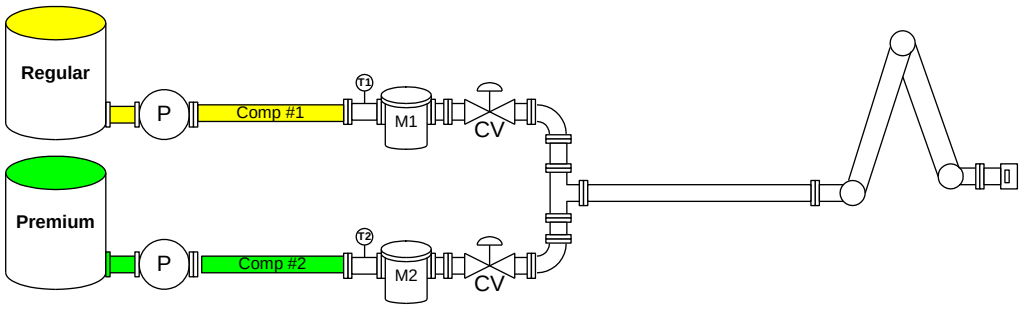


Figure 5.4 Ratio Blending Application

To perform Ratio Blending, two to five meter runs must be constructed to deliver each component through a single load arm. Each meter run will consist of one flow meter and one control valve. The MultiLoad will deliver each of the recipe components simultaneously. The MultiLoad will attempt to keep the total blend ratio within the range established by the Blend Adjust Deviation % throughout the load.

During the Low Flow Start stage, the combined flow rate of all meter runs will be controlled to maintain the flow rate configured for the Low Flow Start Rate parameter. The low flow rate for each component will be determined by the ratio of that component in a given blend. For example, a two component blend that has a 50/50 ratio will produce equal flows through the two meters during the Low Flow Start stage. The low flow rate through each meter will equal 50 percent of the Low Flow Start Rate. The resulting flow through any meter must not violate the rate specified in the Minimum Flow Rate parameter. The message "Invalid Recipe" will be displayed prior to loading if this limit is violated. A meter's Minimum Flow Rate value is configured in the Meter menu for each flow meter assigned to the preset.

As the load transitions into High Flow, the flow rate through each meter used in the blend will increase proportionally until the High Flow Rate is reached. The flow rate through each meter will be a percentage of the High Flow Rate. The resulting flow through any meter must not violate the rate specified in the Maximum Flow Rate parameter. The message "Invalid Recipe" will be displayed prior to loading if this limit will be violated. The meter Maximum Flow Rate value is configured in the Meter menu for each flow meter assigned to the preset.

Each component used in a given recipe will transition to the 1st Stage Trip phase when it reaches the 1st Stage Trip Volume. The 1st Stage Trip Volume is configured in the Component menu for each component that is assigned to the preset. Each component will probably reach the 1st Stage Trip Volume at slightly different times. The flow rates through each meter will decrease to the rate specified in the 1st Stage Trip Flow Rate. The MultiLoad will keep all the flow rates in proportion to one another while they are in the 1st Stage Trip phase. The combined flow rate will not exceed the High Flow Rate, but it may exceed the rate of any individual 1st Stage Trip Flow Rate.

After each component completes the 1st Stage Trip phase, each component will transition to the 2nd Stage Trip phase when it reaches the 2nd Stage Trip Volume. The 2nd Stage Trip Volume is configured in the Component menu for each component that is assigned to the preset. Each component will probably reach the 2nd Stage Trip Volume at slightly different times. The flow rates through each meter will decrease to the rate specified in the 2nd Stage Trip Flow Rate. The MultiLoad will keep all the flow rates in proportion to one another while they are in the 1st Stage Trip phase. The combined flow rate will not exceed the High Flow Rate, but it may exceed the rate of any individual 2nd Stage Trip Flow Rate.

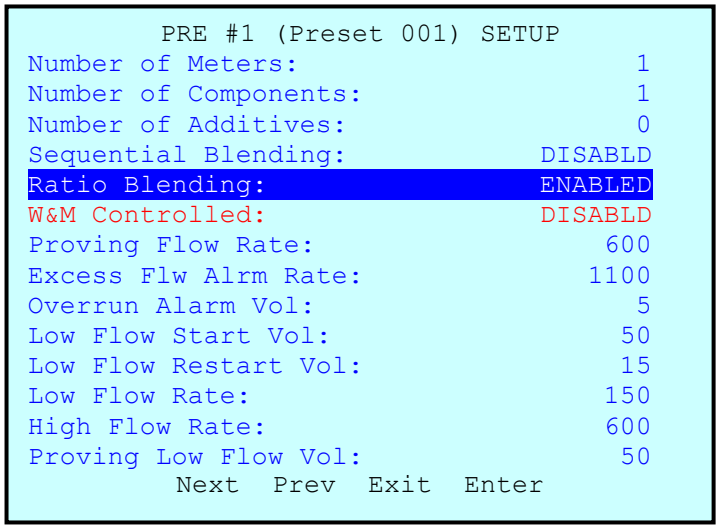
As each component completes its requirement for the load, its control valve will close. Each component will probably finish at slightly different times.

5.4.1 RATIO BLENDING CONFIGURATION

Preset Setup

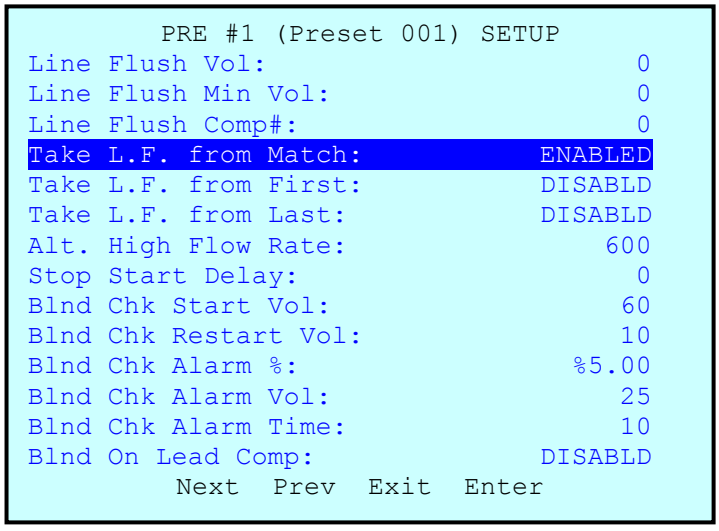
Preset configuration for Ratio Blending is accomplished on the Preset Setup screen shown below.

Configure the preset or the load arm for ratio blending by indicating the number of flow meters that will be assigned to the preset. Typically for ratio blenders, two meter runs are employed. Up to five meter runs can be used if desired. Indicate the number of components that will be delivered through the load arm. There will be one component for each meter that exists at the load arm.


PRE #1 (Preset 001) SETUP
Number of Meters: 1
Number of Components: 1
Number of Additives: 0
Sequential Blending: DISABLD
Ratio Blending: ENABLED
W&M Controlled: DISABLD
Proving Flow Rate: 600
Excess Flw Alrm Rate: 1100
Overrun Alarm Vol: 5
Low Flow Start Vol: 50
Low Flow Restart Vol: 15
Low Flow Rate: 150
High Flow Rate: 600
Proving Low Flow Vol: 50
Next Prev Exit Enter

Enable the Ratio Blending parameter. Sequential Blending can also be performed on the same load arm if product selection (block) valves are employed.

The next step is to configure the Blend Check parameters.


PRE #1 (Preset 001) SETUP
Line Flush Vol: 0
Line Flush Min Vol: 0
Line Flush Comp#: 0
Take L.F. from Match: ENABLED
Take L.F. from First: DISABLD
Take L.F. from Last: DISABLD
Alt. High Flow Rate: 600
Stop Start Delay: 0
Blnd Chk Start Vol: 60
Blnd Chk Restart Vol: 10
Blnd Chk Alarm %: %5.00
Blnd Chk Alarm Vol: 25
Blnd Chk Alarm Time: 10
Blnd On Lead Comp: DISABLD
Next Prev Exit Enter

The Blend Check parameters tell the controller when to begin checking the blend ratio for conformance to the recipe tolerances. The Blend Check Start and Blend Check Restart Volumes are intended to prevent the checks from being made during flow stage transitions, such as Low Flow Start. Toptech recommends setting these parameters to prevent blend checking until the flow rate has stabilized at the High Flow Rate. When these transition volumes have passed, the load will stop if the ratio percentage falls outside of the Blend Check Alarm Percentage parameter. The ratio must be out of tolerance for the period specified by the Blend Check Alarm time. The alarm can also be activated based on volumetric error rather than a percentage error. This is accomplished via the Blend Check Alarm Volume parameter.

Parameter	**Default Setting**
Blend Check Start Volume	60 gallons
Blend Check Restart Volume	10 gallons
Blend Check Alarm %	5 %
Blend Check Alarm Volume	25 gallons
Blend Check Alarm Time	10 seconds

Blend Adjust parameters are the next parameters to be configured. Based on the Blend Checks, Blend Adjustments will be made depending on the configuration of these parameters. The controller will always attempt to keep the blend to within the percentage dictated by the Blend Adjust Deviation Percentage. No attempts at adjustment will be made until the Blend Adjust Start or Blend Adjust Restart Volumes have passed.

The Blend Adjust Deviation Percentage or the Blend Adjust Deviation Volume must be violated for the period specified by the Blend Adjust Time, before any adjustments are made.

The Blend Adjust Start and Restart volumes should be set to values less than the values set for the Blend Check Start and Restart Volumes, respectively.

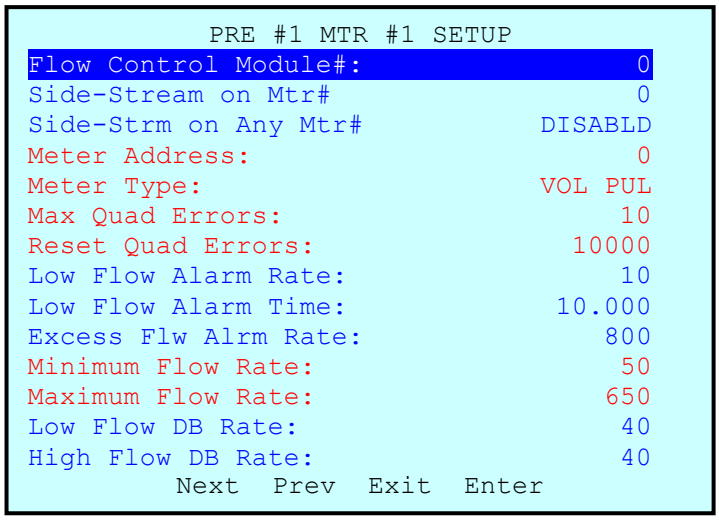
Parameter	**Default Setting**
Blend Adjust Start Volume	60 gallons
Blend Adjust Restart Volume	10 gallons
Blend Adjust Deviation %	1%
Blend Adjust Deviation Volume	5 gallons
Blend Adjust Time	5 seconds

For detailed parameter descriptions, please refer to the Configuration chapter topic “Preset Setup.”

Meter Setup

It will be necessary to configure Meter parameters for each flow meter. Select the appropriate preset and meter. On the Meter Setup screen, enter the Flow Control Module number that will receive the flow meter input. Valid choices are 0-31. The FCM number is determined by the communication address of the module. The address is determined by the setting of the DIP switch (S1) that is located on the FCM. The switch position indicates a binary zero when it is in the Off position; a binary one is represented by a switch in the On position.

The A channel of the flow meter signal will always be on Port 4 of the selected Flow Control Module. If a channel B signal is used for pulse security that input will always be connected to Port 5. If channel B is not used, Port 5 can be assigned to some other I/O function. Port 2 will automatically be assigned to be the control valve's Upstream Solenoid signal. Port 3 will be used for the control valve's Downstream Solenoid signal.


PRE #1 MTR #1 SETUP
Flow Control Module#: 0
Side-Stream on Mtr# 0
Side-Strm on Any Mtr# DISABLD
Meter Address: 0
Meter Type: VOL PUL
Max Quad Errors: 10
Reset Quad Errors: 10000
Low Flow Alarm Rate: 10
Low Flow Alarm Time: 10.000
Excess Flw Alrm Rate: 800
Minimum Flow Rate: 50
Maximum Flow Rate: 650
Low Flow DB Rate: 40
High Flow DB Rate: 40
Next Prev Exit Enter

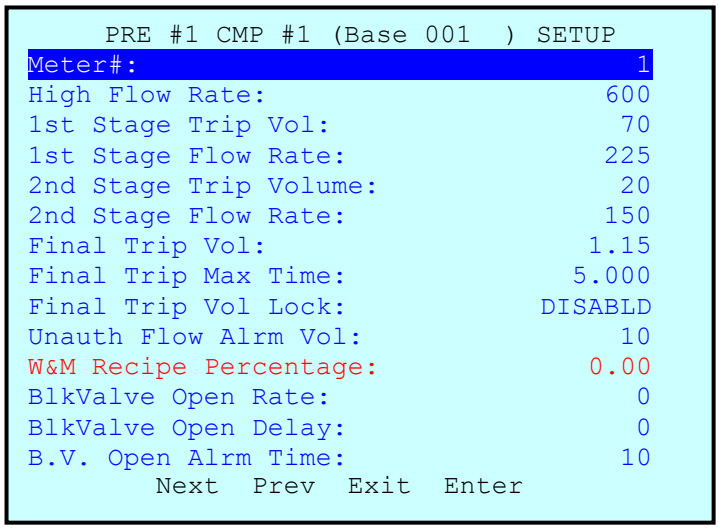
The Dead Band rates for the flow stages are configured on the Meter Setup screen. No valve adjustments will be attempted when the flow rate is within the dead band. Whenever flow drifts outside of the dead band, the valve will make adjustments to bring the flow rate back within the dead band. If multiple meters are assigned to the preset, repeat this process for the other meters.

Two additional ratio blending parameters are found on the Meter Setup screen. The Ratio Adjust Proportional Factor and the Ratio Adjust Derivative Factor have been configured at the factory. These parameters should not be adjusted without consulting Toptech Systems.

Parameter	Default Setting
Flow Control Module #	0
1st Stage Dead Band Rate	40 gallons per minute
2nd Stage Dead Band Rate	40 gallons per minute

Component Setup

For ratio blending, each component must have its own meter. Assign the component #1 to Meter #1. Assign the component #2 to Meter #2, and so on.


PRE #1 CMP #1 (Base 001) SETUP
Meter#: 1
High Flow Rate: 600
1st Stage Trip Vol: 70
1st Stage Flow Rate: 225
2nd Stage Trip Volume: 20
2nd Stage Flow Rate: 150
Final Trip Vol: 1.15
Final Trip Max Time: 5.000
Final Trip Vol Lock: DISABLD
Unauth Flow Alrm Vol: 10
W&M Recipe Percentage: 0.00
BlkValve Open Rate: 0
BlkValve Open Delay: 0
B.V. Open Alrm Time: 10
Next Prev Exit Enter

The Pump Run port assignment for the component is also configured on this screen. Additionally, there is a Pump Kill output that can be assigned to provide a signal to remove power from the pump. An option also exists to configure a Pump Status signal to provide positive verification that a pump is running. The pump related input and output signals can be assigned to any Flow Control Module.

The 1st Stage Trip and the 2nd Stage Trip parameters are also defined on this Screen. Enter the volume and rate that defines the 1st Stage Trip and 2nd Stage Trips.

Parameter	Default Setting
1st Stage Trip Volume	70 gallons
1st Stage Trip Flow Rate	225 gallons per minute
2nd Stage Trip Volume	20 gallons
2nd Stage Trip Flow Rate	150 gallons per minute
Pump Run FCM#	Disabled
Pump Kill FCM#	Disabled
Pump Status FCM#	Disabled

For detailed parameter descriptions, please refer to *General Configuration* chapter topic “Component Setup.”

5.5 SIDE-STREAM BLENDING (EXCLUDING SMP)

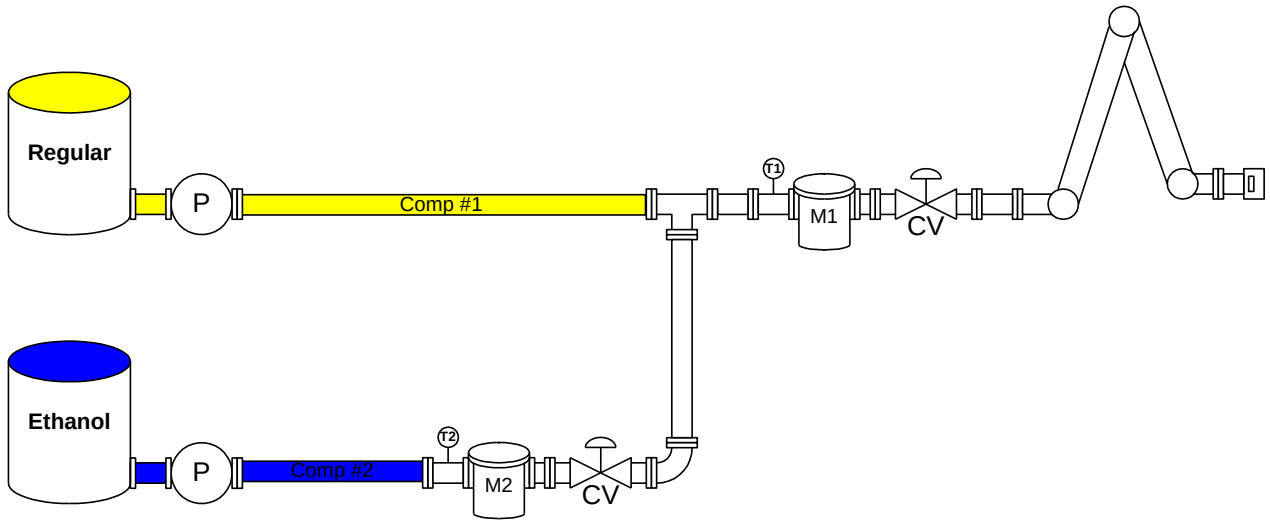


Figure 5.5 Simple Side-Stream Application

Side-Steam blending is similar to Ratio blending in that two or more components are delivered simultaneously to achieve a blend. Each component incorporates its own control valve and flow meter. In a side-stream configuration, minor component(s) are injected upstream of the major component's flow meter (primary meter). Flow through the primary meter flows at the rate dictated by the preset-level High Flow Rate parameter. The flow rate of the side-stream component tracks the flow rate of the primary meter. The side-stream seeks to maintain its rate at a pre-programmed ratio of the rate that is being controlled through the primary meter/valve. The primary meter measures the commingled major and minor components.

5.5.1 SIMPLE SIDE-STREAM BLENDER CONFIGURATION

When configuring a load arm to be a side-stream blender, begin at the preset-level. At the preset-level, define the number of flow meters and components (liquids) that will be delivered through the load arm. A maximum of five flow meters and eight components can be assigned to a load arm. Enable the Ratio Blending parameter found at the preset-level.

At the meter-level configuration, default values can typically be used for the primary meter (Meter 1). When configuring parameters for Meter 2, enter a value in the Side-Stream On Mtr# parameter. By entering a value of 1 for this parameter, Meter 2 is designated to be a side-stream of Meter 1. It will probably be necessary to adjust the Flow and Dead Band rates of Meter 2, since the side-stream meter is typically smaller than the primary stream's meter. Reference the table for suggested settings. The Maximum Flow Rate and Minimum Flow Rate parameters for Meter 2 will also need to be adjusted to match the flow meter manufacturer's specifications.

At the component-level configuration, the components are assigned to a particular meter, using the Meter# parameter. Component 1 is typically assigned to Meter 1 and Component 2 is typically assigned to Meter 2.

Preset	Meter (Meter 2)	Components 1 & 2 Component-To-Meter Assignment “Meter #” Parameter
Number of Meters: 2	Side-Stream on Meter # = 1	Component 1: Meter # = 1
Number of Components: 2	Low Flow DB Rate 10 gpm	Component 2: Meter # = 2
Ratio Blending: Enable	High Flow DB Rate 10 gpm	
Seq. Blending: Disable	1st Stage DB Rate 10 gpm	
	2nd Stage DB Rate 10 gpm	

Weights & Measures - Meters
Minimum Flow Rate 5 gpm
Maximum Flow Rate 100 gpm

Figure 5.6 Simple Side-Stream Configuration

5.6 HYBRID BLENDING (EXCLUDING SMP)

The MultiLoad architecture permits hybrid blending schemes, where there may be multiple side-streams or multiple, major components that flow through the primary stream.

5.6.1 MULTIPLE SIDE-STREAMS

Since five flow meters can be assigned to one load arm, it is possible to have multiple side-streams serving a primary meter. The key to supporting multiple side-streams is designating meters as side-stream meters when performing the meter-level configuration.

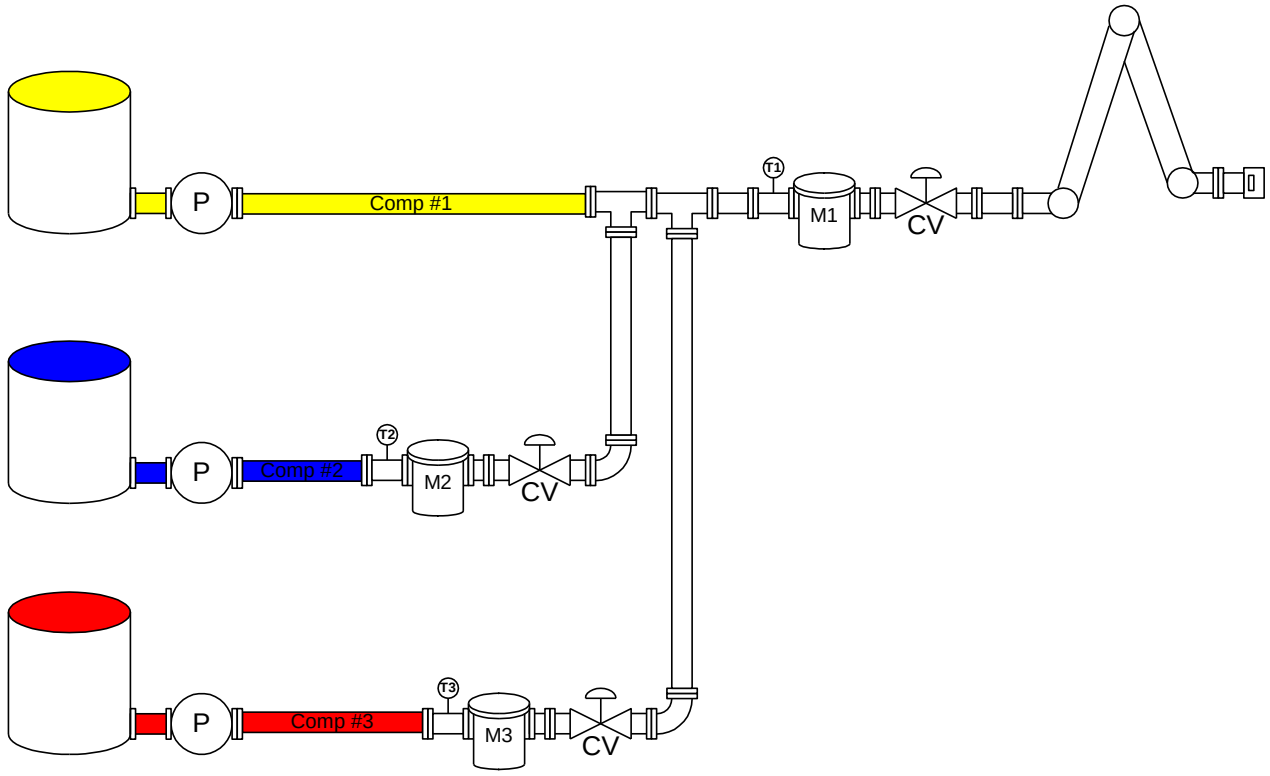


Figure 5.7 Multiple Side-Stream Application

The following table identifies the configuration parameters necessary to support the diagram in Figure 5.3. Meter #2 and Meter #3 are both designated as side-stream meters of Meter #1. Four side-stream meters could potentially be assigned to this load arm.

Preset	Meter (Meter #2)	Meter (Meter #3)	Components 1-3 Component-To-Meter Assignment “Meter #” Param.
Number of Meters: 3	Side-Stream on Meter # = 1	Side-Stream on Meter # = 1	Component 1: Meter # = 1
Number of Components: 3	Low Flow DB Rate 10 gpm	Low Flow DB Rate 10 gpm	Component 2: Meter # = 2
Ratio Blending: Enable	High Flow DB Rate 10 gpm	High Flow DB Rate 10 gpm	Component 3: Meter # = 3
Seq. Blending: Disable	1st Stage DB Rate 10 gpm	1st Stage DB Rate 10 gpm	
	2nd Stage DB Rate 10 gpm	2nd Stage DB Rate 10 gpm	

Weights & Measures Meter #2	Weights & Measures Meter #3
Minimum Flow Rate 5 gpm	Minimum Flow Rate 5 gpm
Maximum Flow Rate 100 gpm	Maximum Flow Rate 100 gpm

Figure 5.8 Multiple Side-Stream Configuration

5.6.2 SEQUENTIAL BLENDING WITH SIDE-STREAM

Sequential blending with a side stream component is a hybrid-blending scheme. As each component is delivered in turn through the primary stream, a minor component is being blended into the primary stream, upstream of the primary flow meter.

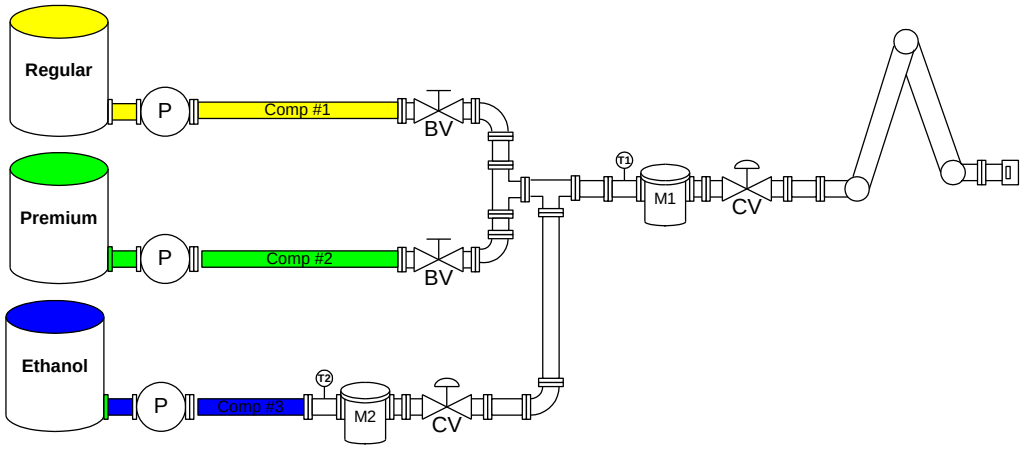


Figure 5.9 Sequential Blending with Side-Stream Application

At the preset-level, define the number of flow meters and components (liquids) that will be delivered through the load arm. In this example, there will be two flow meters and three components. Enable Ratio Blending and Sequential Blending parameters found at the preset-level.

At the meter-level configuration, default values can typically be used for the primary meter (Meter 1). When configuring parameters for Meter 2, enter a value in the Side-Stream On Mtr# parameter. By entering a value of 1 for this parameter, Meter 2 is designated to be a side-stream of Meter 1. It will probably be necessary to adjust the Dead Band rates of Meter 2, since the side-stream meter is typically smaller than the primary stream's meter. Reference the table for suggested settings. The Maximum Flow Rate and Minimum Flow Rate parameters for Meter 2 will also need to be adjusted to match the flow meter manufacturer's specifications.

At the component-level configuration, the components are assigned to a particular meter, using the Meter# parameter. Referencing the diagram in Figure 5.4, Component 1 and Component 2 are assigned to Meter 1 and Component 3 is assigned to Meter 2.

Preset	Meter (Meter 2)	Components 1-3 Component-To-Meter Assignment “Meter #” Param.
Number of Meters: 2	Side-Stream on Meter # = 1	Component 1: Meter # = 1
Number of Components: 3	Low Flow DB Rate 10 gpm	Component 2: Meter # = 1
Ratio Blending: Enable	High Flow DB Rate 10 gpm	Component 3: Meter # = 2
Seq. Blending: Enable	1st Stage DB Rate 10 gpm	
	2nd Stage DB Rate 10 gpm	

Weights & Measures - Meter #2
Minimum Flow Rate 5 gpm
Maximum Flow Rate 100 gpm

Figure 5.10 Sequential Blending with Side-Stream Configuration

At the component-level, I/O assignments can be made for product pumps and product selection valves (Block Valves), etc.

5.6.3 RATIO BLENDING WITH SIDE-STREAM

Side-Stream meters can be added to meter runs that are part of a ratio blending load arm.

- A side-stream can be configured to serve one of a ratio arm's primary streams.
- A side-stream can be configured to serve multiple streams of a ratio load arm.
- Multiple side-streams can be assigned to a ratio-blending arm.
- Up to five flow meters can be assigned to a load arm, regardless of meter function (side-stream meter or primary stream meter).

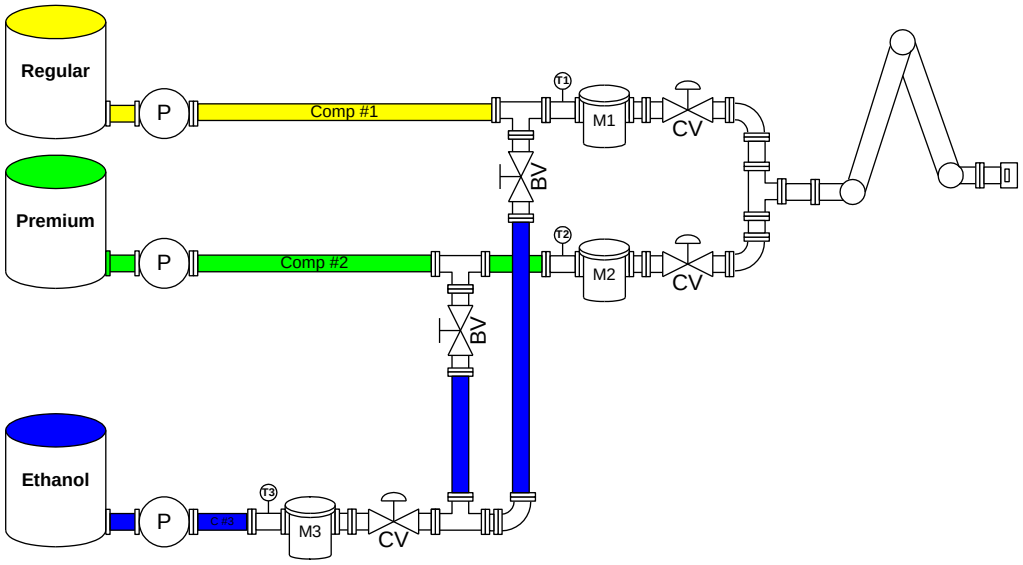


Figure 5.11 Ratio Blending with Side Stream Application

The example shows a single side-stream meter serving two primary components of a ratio blender. The side-stream meter will only flow into one of the primary streams during a given batch. In the event that two primary streams are used in a blend, the side-stream meter will still only flow into one of the primary streams.

At the preset-level, define the number of flow meters and components (liquids) that will be delivered through the load arm. In this example there will be three flow meters and three components. Enable the Ratio Blending parameter found at the preset-level.

At the meter-level configuration, default values can typically be used for the primary meters (Meter 1 & Meter 2). When configuring parameters for Meter 3, enter a value in the Side-Stream On Mtr# parameter. By entering a value of 1 for this parameter, Meter 3 is designated to be a side-stream of Meter 1. If it is necessary to flow through more than one primary stream, also enable the parameter "Side-Stream on Any Meter" under Meter 3 configuration. This will allow the side-stream meter to flow into another primary stream if Meter 1 is not used in the blend. The side-stream meter will always expect to flow through Meter 1 when Meter 1 is used in a blend, due to the setting of the Side-Stream On Mtr# parameter.

It will probably be necessary to adjust the Dead Band rates of Meter 3, since the side-stream meter is typically smaller than the primary stream meters. Reference the table for suggested settings. The Maximum Flow Rate and Minimum Flow Rate parameters for Meter 3 will also need to be adjusted to match the flow meter manufacturer's specifications.

At the component-level configuration, the components are assigned to a particular meter, using the Meter# parameter. Referencing the diagram in Figure 5.5, Component 1 is assigned to Meter 1, Component 2 is assigned to Meter 2 and Component 3 is assigned to Meter 3.

Preset	Meter (Meter 3)	Components 1-3 Component-To-Meter Assignment "Meter #" Param.
Number of Meters: 3	Side-Stream on Meter # = 1	Component 1: Meter # = 1
Number of Components: 3	Side-Stream on Any Mtr: Enabled	Component 2: Meter # = 2
Ratio Blending: Enable	Low Flow DB Rate 10 gpm	Component 3: Meter # = 3
Seq. Blending: Disable	High Flow DB Rate 10 gpm	
	1st Stage DB Rate 10 gpm	
	2nd Stage DB Rate 10 gpm	

Weights & Measures - Meter #3
Minimum Flow Rate 5 gpm
Maximum Flow Rate 100 gpm

Figure 5.12 Ratio Blending with Side Stream Configuration

At the component-level, I/O assignments can be made for product pumps, etc. The product selection (BV) valves used in this example are not configured in the Component section, however. They are operated by a Custom Logic routine. The following routine can be used to steer the Side-Stream component into the Meter 2 stream, when Meter 1 is not used in a blend.

Custom Logic is configured in the Configuration/Custom Logic Menu. Lines 000 through 005 direct the BV for Component 1 to open, when Meter 1/Component 1 is used in the blend. If both Meter 1 and Meter 2 are being used to make a blend, the side-stream will default to Meter 1. Lines 006-011 direct BV2 to open when Meter 1/Component 1 is not used in a blend.

```
000 P01 M03 Side-Stream on Mtr
001 Set Value = 1
002 [000] Equals [001]
003 P01 C03 Open BV
004 [002] AND [003]
005 FCM OUTPUT XX.Y = [004]
006 P01 M03 Side-Stream on Mtr
007 Set Value = 2
008 [006] Equals [007]
009 P01 C03 Open BV
010 [008] AND [009]
011 FCM OUTPUT XX.Y = [010]
```

Note: XX = FCM#, Y = FCM port#, P01 = preset #1, M03 = meter #3, C03 = component #3

5.7 PROVING SIDE-STREAM METERS (EXCLUDING SMP)

It is assumed that proving connections will be used to by-pass the primary meter and valve in order to flow through the side-stream meter into a calibration vessel. Prior to proving a side-stream meter, make the following configuration changes.

For firmware version prior to 3.28.21

1. Enter Program Mode
2. Go to menu Configuration/Equipment Setup/Meter. Select the appropriate Preset.
3. Select the appropriate side-stream meter. This is usually Meter 2.
4. Find the parameter labeled “Side-Stream on MTR#” Change this parameter to 0.
5. Exit Program mode by pressing the EXIT key six times.
6. Proceed with the proving process.
7. Upon completion of the proving process, re-enter program mode and change the Side-Stream on MTR# parameter back to its original setting. The value is usually **1**.

For firmware version 3.28.21 and later

The above configuration changes are not necessary provided that the Host System has indicated that this is a Proving Transaction or that the Meter Proving Mode parameter has been enabled in Configuration->RCU Setup.

5.8 LINE FLUSH (EXCLUDING SMP)

Load arms that handle multiple components often have the need to lay the line with a specific component at the end of the load. If the line is not flushed at the end of a load, the pipe segment between the flow meter and the end of the load arm will contain the component that was delivered last. This may be undesirable for the load that follows. The Line Flush feature is designed to have the line laid with the component of choice at the end of each load. This component of choice is called the Line Flush Component.

The first step to take when considering line flush is to determine the volume of liquid that is contained between the end of the flow meter and the end of the load arm. The MultiLoad will subtract this volume from the preset quantity and stop the loading of a non-flush component when the remaining quantity is equal to the Line Flush Volume. The Line Flush Component will then be metered to satisfy the preset quantity. After the Line Flush Component is metered, it will remain in the line segment beyond the flow meter. The Line Flush Component is not delivered during the load in which it was metered, but it will be delivered in a subsequent load. In effect, the Flush Component is the first product into the truck, but it is not metered as part of the load until the Line Flush stage at the load's end.

The second step is to decide what the Line Flush Minimum Volume will be. This parameter is intended to prevent nuisance alarms from occurring if the volume that is actually flushed in a load is not exactly equal to the Line Flush Volume. The Line Flush Minimum Volume value must be less than the Line Flush Volume, but it must represent an acceptable volume of flush. The Line Flush Minimum Volume value will be displayed on the Status screen during loading; as the flush occurs the value will decrement to zero. If a flush does not meet the minimum volume, a Line Flush alarm will activate. In the event of a Line Flush alarm, the amount of flush volume required to satisfy the Line Flush Minimum Volume would be displayed. This information will help terminal personnel decide what corrective action to take.

The last step is to identify the component to be used to flush the line at the end of each load. Enter a numerical value that represents the flush component in the Line Flush Component # parameter.

The parameters discussed in this section are found on the Preset Setup screen, shown here.

```
        PRE #1 (Preset 001) SETUP
Line Flush Vol:                    0
Line Flush Min Vol:                0
Line Flush Comp#:                  0
Take L.F. from Match:          ENABLED
Take L.F. from First:          DISABLD
Take L.F. from Last:           DISABLD
Alf. High Delay:                   0
Stop Start Delay:                  0
Blnd Chk Start Vol:               60
Blnd Chk Restart Vol:             10
Blnd Chk Alarm %:               %5.00
Blnd Chk Alarm Vol:               25
Blnd Chk Alarm Time:              10
Blnd On Lead Comp:             DISABLD
         Next  Prev  Exit  Enter
```

Whenever the flush component is being delivered outside of the flush stage, the minimum flush requirement on the Status screen will return to zero, as the Line Flush Minimum Volume is achieved. This register immediately increases to the Line Flush Minimum Volume value as soon as any non-flush component is delivered into the line. Consider the example of a sequential blend where component #1 is the flush component but the load is aborted during component #1 delivery; component #2 nor the Flush is delivered. Although technically the flush never occurred, the Flush feature will not alarm since it knows that the line is filled with component #1, which happens to be the flush component. The alarm will not activate, provided that the minimum flush requirement was met during component #1 loading.

To deactivate the Line Flush feature, set the values of the first three parameters in the table below to zero. The remaining flush parameters are related to blending.

Parameter Name	Default Setting	Screen Location
Line Flush Volume	0 gallons	Preset Setup
Line Flush Minimum Volume	0 gallons	Preset Setup
Line Flush Component #	0 (no component selected)	Preset Setup
Take Line Flush From Match	Enabled	Preset Setup
Take Line Flush From First	Disabled	Preset Setup
Take Line Flush From Last	Disabled	Preset Setup

Line Flush and Blending

When blending multiple components through a load arm, one of the product components will have to be shorted by a volume equal to the Line Flush Volume. There are three Line Flush parameters that can be configured to determine which component is shorted. The MultiLoad will consider each parameter in the order that it is listed in the table above. If the conditions of the first parameter do not resolve the question of which parameter to short, the parameter that follows the first will be considered, and so on.

The first decision parameter is Take Line Flush From Match. This parameter, if enabled, will instruct the MultiLoad to determine if the flush component is used in the product. If the Flush Component is used in the product, it will short that component by the Line Flush Volume amount. The deficit will be made up during the Line Flush stage. If the flush component is not used in the product recipe or if the parameter is disabled, the MultiLoad will look to the next parameter for instruction.

The second decision parameter is Take Line Flush From First. This decision will be considered if the previous parameter is disabled or if the previous decision was not resolved. If this parameter is enabled, the MultiLoad will short the first component in the recipe; the first component will be shorted by the Line Flush Volume. If this parameter is disabled, MultiLoad will look to the third decision parameter.

The third decision parameter is Take Line Flush From Last. This parameter must be enabled if the two previous parameters are disabled. MultiLoad will subtract the Line Flush Volume from the last component in the recipe. The preset quantity will be satisfied by the Line Flush Component during the Line Flush stage.

Example

The following table shows how a 1000 gallon load is affected by each of the decision parameters. The product is a 60/40 blend. Component #1 is 60% of the total, and component #2 is 40% of the total. The Line Flush Component is component #1. The Line Flush Volume is 100 gallons.

Component #	Desired Ratio	Quantity Delivered	Flush Option
Example 1			
1	600	500	Take Flush from Matching Component
2	400	400	
Flush		100	Line Flush Component is component #1
Preset Total	1000	1000	
Example 2			
1	600	500	Take Flush From First Component
2	400	400	
Flush		100	Line Flush Component is component #1
Preset Total	1000	1000	
Example 3			
1	600	600	Take Flush From Last Component
2	400	300	
Flush		100	Line Flush Component is component #1
Preset Total	1000	1000	

In Example 1, using Take Flush From Matching Component results in a 60/40 blend. The first component is shorted by 100 gallons, but it is made up at the end of the load, since the first component is also the flush component.

Example 2 produces identical results. The MultiLoad will short the first component in the product recipe, which happens to be the designated flush component.

In Example 3, when the Take Flush From Last Component is executed, the resulting product ratio is 70/30. The last component (component #2) is shorted by 100 gallons and the preset quantity is satisfied by flush component, which is component #1. The desired 60/40 result would have been achieved in this case if component #2 had been designated as the Line Flush Component.

5.9 RATIO BLENDING CONSIDERATIONS (EXCLUDING SMP)

When Ratio Blending, all product recipe components are flowing simultaneously. Any time Ratio Blending is occurring, a flush requirement appears on the Status screen, since a mixture of components exists in the line. Before the ratio-blended load begins, the algorithm decides which component to short. When the remaining preset quantity is equal to the Line Flush Volume, the flow of all blended components is stopped. Then the flush stage will begin, where only the Line Flush Component is flowing. All non-flush components in the product recipe must have delivered their required volumes by this time. When blends are aborted before flush occurs or before the Line Flush Minimum Volume has been delivered, the Line Flush alarm is activated. The volume of flush error will be displayed on the Status screen.

If flush is involved with ratio blending, the setting of the Blend Check Alarm % can prevent loads of certain quantities from being delivered, because the blend will be forced to be temporarily out of specification prior to beginning the flush phase. This determination is made before loading starts.

Example

The Blend Check Alarm % is set to 5% and a preset of 1000 gallons is selected for a 60/40 load in which component #2 is the flush component. The Flush Volume is 100 gallons. The 600 gallon requirement of component #1 has to be completely delivered by the time the last 100 gallons of flush is started. When ratio flow stops to begin the flush phase and before the flush is started the ratio will be 600/300. This will result in a 6.7% error until the flush begins. The load will be stopped for a blend specification violation. To deliver 1000 gallon loads in this case, the Blend Check % alarm setting will have to be relaxed to 7%.

Review the section on Ratio Blending in this chapter for configuration details.

The flush feature for loading straight product from a ratio blending preset works the same as when the loading is conducted by a sequential recipe.

The following table shows how a 1000 gallon load is affected by each of the decision parameters. The product is a 60/40 blend. Component #1 is 60% of the total and component #2 is 40% of the total. The Line Flush Component is component #2. The Line Flush Volume is 100 gallons.

Line Flush Delivery for Various Line Flush Options – Ratio Blending

Component #	Desired Ratio	Quantity Delivered	Flush Option
Example 1			
1	600	600	Take Flush from Matching Component
2	400	300	
Flush		100	Flush component #2
Preset Total	1000	1000	
Example 2			
1	600	500	Take Flush From First Component
2	400	400	
Flush		100	Flush component #2
Preset Total	1000	1000	
Example 3			
1	600	600	Take Flush From Last Component
2	400	300	
Flush		100	Flush component #2
Preset Total	1000	1000	

In Example 2, when the Take Flush From First Component is executed, the resulting product ratio is 50/50, since the non-flush component was shorted (component #1). In this case, the desired 60/40 result would have been achieved by using component #1 as the Line Flush Component.

5.10 CALIBRATION USING METER FACTOR LINEARIZATION

Meter factors are determined during flow meter proving tests by comparing the observed volume with the volume that is indicated on the MultiLoad II display. As the MultiLoad II collects pulses from a flow meter, it divides the pulses by the K-Factor to obtain a Raw Gross Volume. Meter factors are used to correct the Raw Gross Volume so that the volume indicated on the MultiLoad II display matches the volume that is observed during flow meter proving.

Meter factors can vary significantly at different flow rates. For this reason, meter factors are determined for two or more flow rates to improve accuracy over a range of flow rates. The Meter Factor Linearization feature permits the MultiLoad II to interpolate a meter factor when product is flowing in between two flow rates that have proven meter factors.

As product is delivered, the meter factor is continuously applied to the Raw Gross Volume to display the Gross Volume. The meter factor that is applied against the Raw Gross Volume changes as the flow rate varies between two established flow rates.

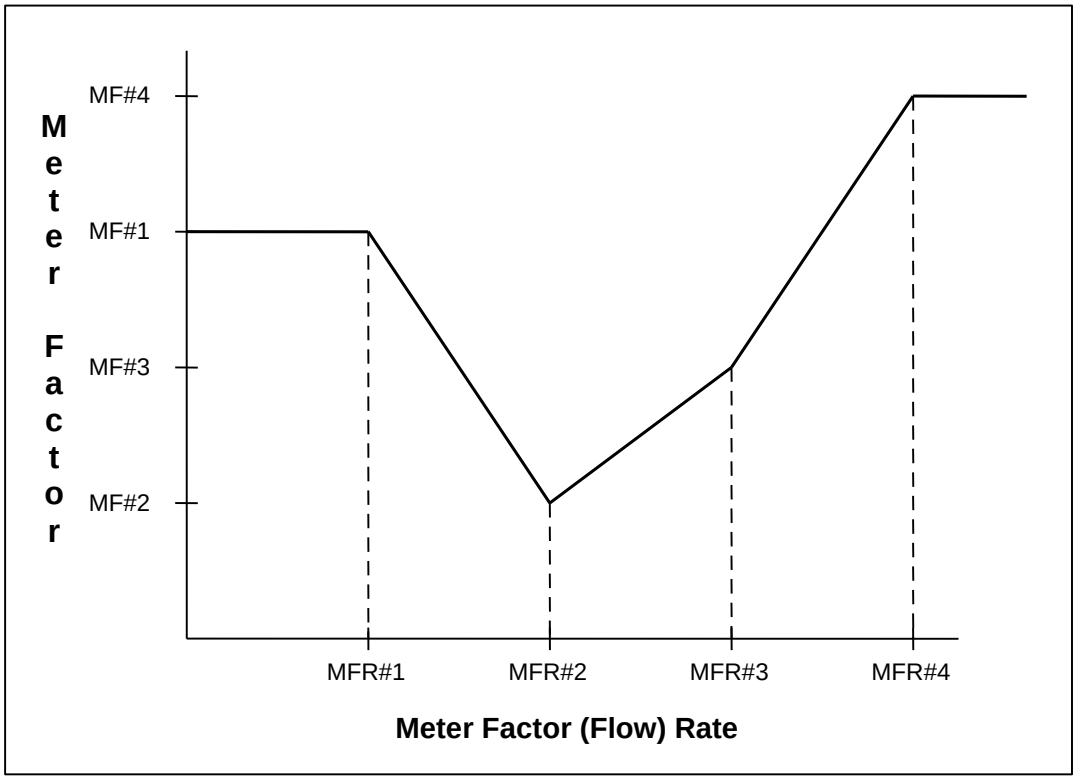


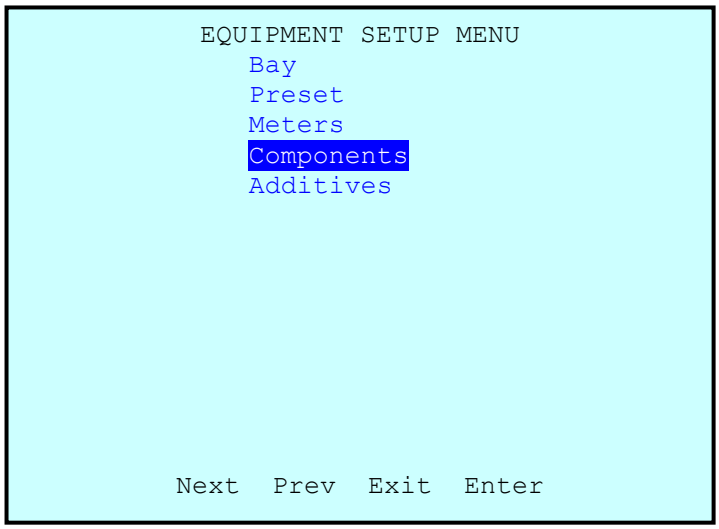
Figure 5.13 Meter Factor Linearization

Meter Factor Configuration

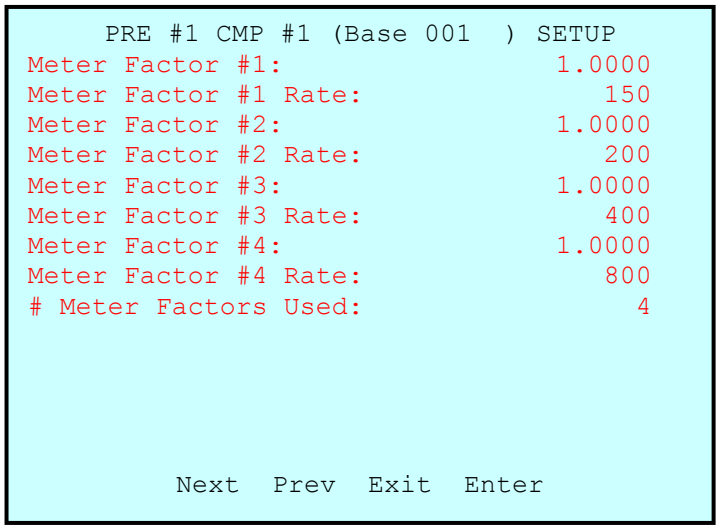
Meter Factors are accessed in Program mode from the Configuration->Equipment Setup Menu, shown below. If multiple components are delivered through the same meter, meter factors must be established for each component. This is particularly important if the physical characteristics of the components, such as density and viscosity, have wide variation.

Meter Factors and Meter Factor Flow Rates are the parameter fields that will be entered. These fields are displayed red and are Weights and Measures protected. When entering the values through the MultiLoad II keypad, the Weights and Measures key switch must be activated to change the value.

From the Configuration->Equipment Setup Menu, select Components.



The Component Setup screen displays:


PRE #1 CMP #1 (Base 001) SETUP
Meter Factor #1: 1.0000
Meter Factor #1 Rate: 150
Meter Factor #2: 1.0000
Meter Factor #2 Rate: 200
Meter Factor #3: 1.0000
Meter Factor #3 Rate: 400
Meter Factor #4: 1.0000
Meter Factor #4 Rate: 800
Meter Factors Used: 4
Next Prev Exit Enter

If two meter factor flow rates are to be established, the lowest flow rate must be the Meter Factor #1 Rate. Enter Meter Factor #1 in the appropriate field. Enter the flow rate that was used to determine the meter factor in the Meter Factor #1 Rate field. When flowing between zero and the Meter Factor #1 Rate, Meter Factor #1 will be applied to the Raw Gross Volume.

The second meter factor should be entered in the Meter Factor #2 field. Enter the flow rate that was used to determine Meter Factor #2 in the Meter Factor #2 Rate field. When flowing between the Meter Factor #1 and the Meter Factor #2 Rates, an interpolated meter factor will be applied to the Raw Gross Volume. The interpolated

meter factor will be a value that lies somewhere between the Meter Factor #1 Rate and Meter Factor #2 Rate. If the flow rate is higher than the Meter Factor #2 Rate, the meter factor that is applied to the Raw Gross Volume will be interpolated between Meter Factor #2 and Meter Factor #3.

If Meter Factor #3 is determined, ensure that the Meter Factor #3 Rate is higher than the Meter Factor #2 Rate. If a meter factor is not determined for Meter Factor #3, enter the meter factor that was determined for the highest proven flow rate. Ensure that the Meter Factor #4 Rate is higher than the Meter Factor #3 Rate.

If a meter factor is determined for Meter Factor #3 and Meter Factor #4, and product flow exceeds the Meter Factor #4 Rate, Meter Factor #4 will be applied to the Raw Gross Volume for all rates that exceed the Meter Factor #4 Rate. If a meter factor is not determined for Meter Factor #4, enter the meter factor that was determined for the highest proven flow rate.

Enter the actual number of configured meter factors (1-4), in # Meter Factors Used parameter.

5.10.1 SINGLE METER FACTOR

Use of a single meter factor can be accomplished by entering the same meter factor value in all four Meter Factor parameters. Meter Factor Flow Rates, however, must have different values.

Example

Meter Factor #1	1.0451
Meter Factor #1 Rate	150
Meter Factor #2	1.0451
Meter Factor #2 Rate	400
Meter Factor #3	1.0451
Meter Factor #3 Rate	600
Meter Factor #4	1.0451
Meter Factor #4 Rate	800

5.10.2 RULES FOR METER FACTORS

If the following conditions are not met, an FCM Conflict Alarm will be raised at time of flow:

- Meter Factor Rates must always adhere to the following rule:

  MF#1 Rate < MF#2 Rate < MF#3 Rate < MF#4 Rate

- Meter Factors must adhere to the following restriction:

  0.8000 < Meter Factor < 1.2000

 # Meter Factors Used-Enter the number of meter factors that will be established for the component. This will prevent configuration errors and subsequent FCM Conflict Alarms.

CHAPTER 6 ADDITIVE CONTROL

6.1 OVERVIEW

Sophisticated additive control is an integral part of the MultiLoad II. Because this control is integrated into the MultiLoad II, the need for discrete additive control devices and their resulting interfaces to the terminal automation system have been eliminated. Up to 16 injectors (2 injectors on SMP) can be assigned to a load arm on MultiLoad II.

Additive injection rates are entered into the MultiLoad II as a percentage of the total product recipe. For example, if the additive injection rate is 0.5000 gallons of additive per 1,000 gallons of product, the percentage of additive in the product recipe would be 0.0500%. Once this number is established, any injection size (Additive Volume Per Injection) can be programmed in the MultiLoad II as long as it falls within the mechanical limitations of the injector. MultiLoad II adjusts the frequency of injections to maintain the correct additive percentage.

This chapter describes the MultiLoad II Additive functions and features. Please review the topics that describe characteristics that are generic to all additive methods before studying the individual methods. The five additive methods discussed in this chapter are:

- Piston Only (calibrated cylinder)
- Piston with Input (calibrated cylinder with feedback switch)
- Solenoid & Pulser Input (additive meter only)
- Common Meter for Multiple Additives
- Analog valve/pump using PID loop control

> Toptech recommends the Solenoid & Pulser Input method because it provides all additive control totalizers and calibration in a very straightforward manner. This method also eliminates the need for any microprocessor-based additive injection equipment, saving considerable expense in additive system training and maintenance.

This chapter also describes the Additive Calibration features available with the MultiLoad II.

6.2 PISTON INJECTOR CYCLES

The Piston Throw Time is a parameter that is configured for all of the piston type methods. The Throw Time is the max time it takes the piston to complete one half cycle. Note this is not a calculated value, but is determined by physically measuring the time it takes the piston to complete one half of a cycle.

When an injection is initiated, the system will assume that the piston has traveled to its maximum extension point when the Throw Time has expired. After the Throw Time has expired, the injection signal is removed and the piston begins its return to the starting position. The time that it takes for the piston to return is assumed to be equal to the piston Throw Time also. The system will not attempt another injection until the return Throw Time has expired. The piston must return to the starting position within this time period. Please refer to Figure 6.1 below.

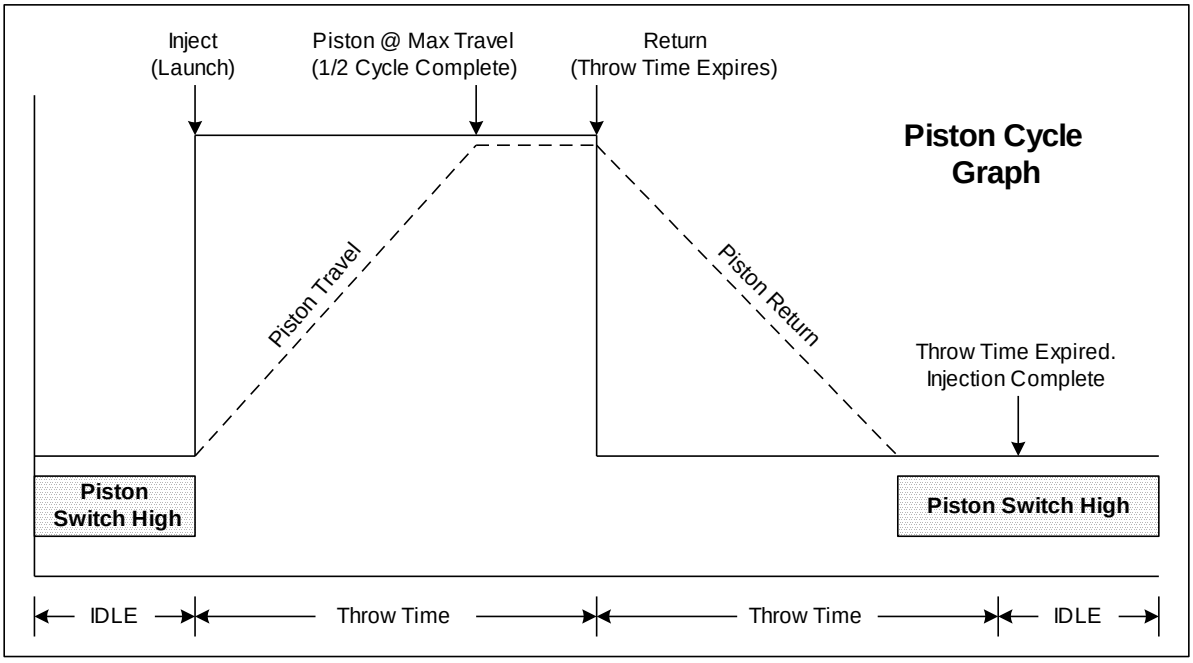


Figure 6.1 Piston Cycle Graph

6.3 ADDITIVE PORT ASSIGNMENT

For most additive methods, an additive output (injection signal) and an additive input are required. During configuration, an additive FCM Port# will be assigned by the user. This port assignment will be for the additive output (injection signal). Valid FCM Port# selections for the additive outputs are ports 0 and 1 on the internal I/O board and 0, 1, 2, and 3 on an external FCM. The output port that is selected will dictate which port is used for the additive input. For example, if Port 0 is selected as the FCM Port#, the output will be on port 0 and the corresponding input will be at port 7. Below is a table of possible port assignments.

When using the Piston Only method, there is no additive input signal to be monitored. However, the input port that corresponds to the selected output port will be dedicated as an additive port. This port will be out of service and cannot be used for any other function.

6.3.1 ADDITIVE OUTPUT PORT AND INPUT PORT ASSIGNMENTS

	Output Port	Input Port
Injector #1	0	7
Injector #2	1	6
Injector #3 (Excluding SMP)	2	5
Injector #4 (Excluding SMP)	3	4

6.4 ADDITIVE UNITS

Additive totals can be displayed in one of two units: cubic centimeters (cc) or thousandths of a unit volume. The parameter to select the desired units for additives, “Display Adtv as CCs,” is accessed from the MultiLoad II Setup screen. When enabled, all additive related displays will show additive totals in cubic centimeters (cc). If disabled, additive totals will be displayed in thousandths of a unit volume.

Additive units will be displayed in thousandths of the volumetric or mass units that are being used by the main components. For example, if the k-factor of the product meter is pulses per liter, additive units will be presented in thousandths of a liter. The option to display additives in cubic centimeters is only valid when the product flow meters are entered in pulses per gallon.

6.5 ADDITIVE CONTROL METHODS

6.5.1 METHOD 1 – PISTON ONLY

The Piston Only method provides for the use of a piston style injector using a calibrated cylinder. This method provides no verification of additive delivery; it merely calls for an injection as the demand for the additive accumulates. An injection will occur as soon as enough product has been delivered to create demand for an additive volume that is equal to one half of one injection. (See Figure 6.2) Injection size is determined by the Volume per Injection parameter. If the injection is successful, one full injection will have been delivered before the demand has reached one full injection. The additive Delivered totalizer will increment by one full injection volume after enough time has passed for the piston to have returned to its starting position. The piston Throw Time parameter determines when the system expects the injection cycle to be completed. (See Figure 6.1)

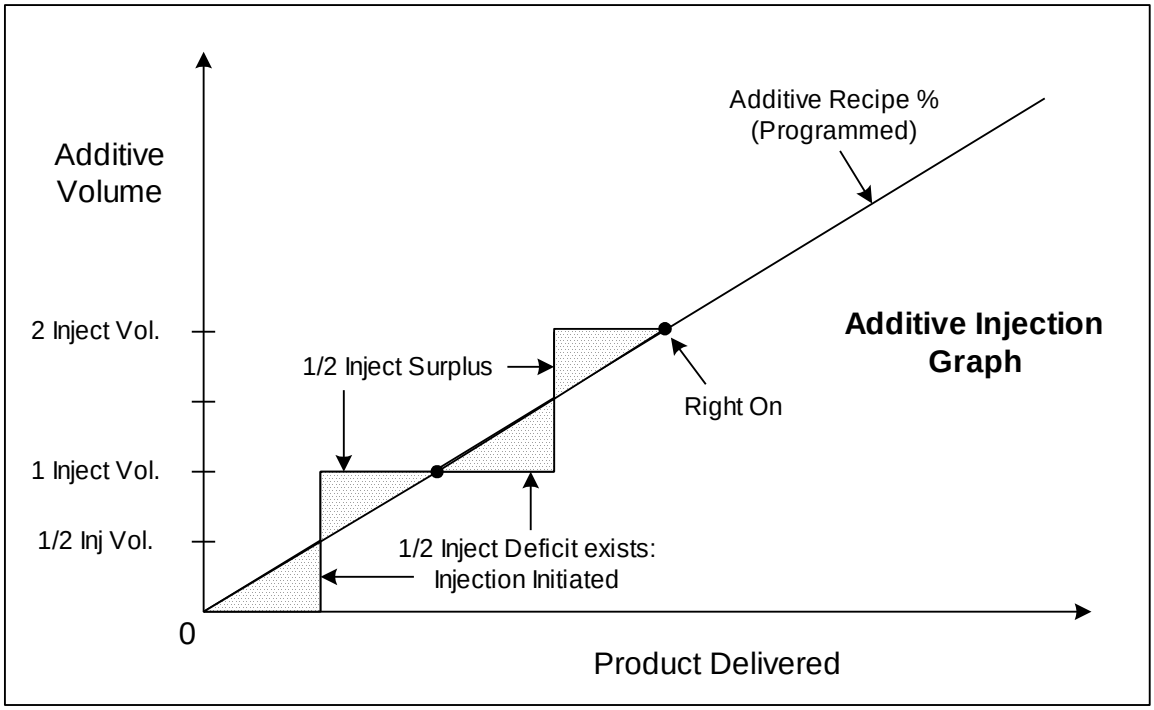


Figure 6.2 Additive Injection

It is possible to experience an additive alarm using this method. Although there is no verification of additive delivery using this method, the system does check the delivered totalizers against the Recipe (target) totalizers. It is possible to get an Under Additized alarm if the additive has been configured to meet a target that it cannot possibly attain. An additive alarm when using this feature indicates that the pace of delivery is beyond the physical capabilities of the injector or that the additive ratio target is unrealistic. An alarm can occur if the Piston Throw Time parameter is set to an excessive duration. The Throw Time configuration will delay further injections in order to allow time for piston travel. If this time is too great, some ratios cannot be attained due to limitations of piston action.

6.5.2 CONFIGURING A PISTON ONLY ADDITIVE

This topic describes the minimum configuration to get an additive to operate with this method. Configuration of these parameters is mandatory. Using the MultiLoad II Configuration Tool or the Remote Control Unit keypad, access the Program mode. From the Configuration Menu, select the preset and additive desired.

Additive Enable	Enable this parameter.
Flow control module #	Set this value to the FCM # where the additive is connected. Set this value to zero for the internal I/O board.
FCM Port #	Select the port that will serve as the Additive Injection Output. Note: A corresponding additive input port will automatically be assigned. See the Additive Port Assignment description above.
Additive Type	Set to 'Pstn'. Multiload will be configured as a Pstn type and will not check the feedback. Also we always expect that everything is injected.
Additive Volume Per Injection	Enter the cylinder volume in the appropriate units. The additive units of volume are configured as cubic centimeters or as thousandths of a gallon.
Piston Throw Time	Enter the time in seconds that it will take for the piston to complete one half of an injection cycle.

The remaining parameters that apply to this additive method are optional. They are used to set up alarming, pump outputs and permissive inputs. Some of the remaining parameters affect how the additive is delivered at different stages of the load cycle. All Additive configuration screens and parameter descriptions are found in the 'General Additive Setup' section that follows.

The "Parameters for Additive Methods" table identifies the parameters that apply to this method.

6.5.3 METHOD 2 – PISTON WITH INPUT (FEEDBACK SWITCH)

This method provides for the use of a piston style injector with a calibrated cylinder. A provision has been made to receive a feedback signal that will verify that the piston has been launched and that it has returned to its starting position. An injection will occur as soon as enough product has been delivered to create demand for an additive volume that is equal to one half of one injection. Injection size is determined by the Volume per Injection parameter. If the injection is successful, one full injection will have been delivered before the demand has reached one full injection. The Additive Delivered totalizer will increment by one full injection volume after enough time has passed for the piston to have returned to its starting position and the appropriate feedback signal has been received at the additive input port. The piston Throw Time parameter determines when the system expects the injection cycle to be completed. (Please see Figure 6.1 for illustration.)

When an injection is commanded, the piston must leave its starting position before the Throw Time has elapsed. The Piston Input (feedback switch) should indicate a change of state when the piston has been launched. The default state is high when the piston is in the starting position, changing to a low state as the piston travels away from its seat. If the Piston Input signal changes to a low state before the Throw Time elapses, the Throw Time timer is reset, pending a command for the piston to return. If the state does not change within the Throw Time, a missed injection will be logged internally. The load can be programmed to raise an alarm after a number of missed injections are logged.

When the Throw Time has elapsed, the additive output (injection) signal will be removed, permitting the piston to return to the starting position. After the output signal has been removed, the Throw Time timer is restarted. The piston must return to the starting position before the Throw Time has elapsed. If the piston returns to its starting position before the Throw Time elapses, the state should change to a high condition. The system would assume that the injection was successful and it would increment the additive totalizer by the quantity specified in the Volume per Injection parameter. If the signal did not change to a high state before the Throw Time elapsed, a missed injection would be logged internally. The system will immediately attempt another injection, assuming that the previous attempt delivered no additive. When the number of missed injections equals the value entered for the Max Pstn Missed Inj (Maximum Piston Missed Injections) parameter, an Injection Fault alarm will be raised and the load will be stopped.

If the piston has successfully returned to its starting position, as determined by the feedback signal, the piston will sit idle until another injection signal is received from the additive output port. Another injection command signal shall be sent to the injector when the demand for additive, based on product delivery, becomes 50% of one injection volume.

6.5.4 CONFIGURING A PISTON WITH INPUT ADDITIVE

This topic describes the minimum configuration required to get an additive to operate using this method. Configuration of the following parameters is mandatory. Using the MultiLoad II Configuration Tool or the Remote Control Unit keypad in Program mode, select the preset and additive desired.

Parameter	**Action**
Additive Enable	Enable this parameter.
Additive FCM#	Set this value to the FCM # where the additive is connected. Set this value to zero for the internal I/O board.
FCM Port #	Select the port that will serve as the Additive Injection Output. Note: A corresponding additive input port will automatically be assigned. See the Additive Port Assignment description above.
Additive Type	Set this value to PstnNFB if the piston input is normally high (Normal Feedback). Set to PstnIFB if the piston input is normally low (Inverted Feedback).
Additive Volume Per Injection	Enter the cylinder volume using the appropriate units.
Piston Throw Time	Enter the time in seconds that it will take for the piston to complete one half of an injection cycle.

The remaining parameters that apply to this additive method are optional. They are used to set up alarming, pump outputs and permissive inputs. Some of the remaining parameters affect how the additive is delivered at different stages of the load cycle. All Additive configuration screens and parameter descriptions are found in the 'General Additive Setup' section that follows.

The "Parameters for Additive Methods" table identifies the parameters that apply to this method.

6.5.5 METHOD 3 – PULSER INPUT

This configuration assumes that a flow measurement device is metering the amount of additive entering the product stream. It is assumed that there is no piston/cylinder and that the additive output port is commanding a solenoid operated valve, which controls the delivery of additive. Instead of incrementing the additive totalizer at each injection or upon receipt of a feedback signal, this feature updates the additive totalizers based upon measured flow.

Because the physical limitations of a piston/cylinder injector are eliminated, the Throw Time parameter is irrelevant. The Volume Per Injection parameter is still valid, however. The Volume Per Injection parameter sets a target pace that the system will inject, if necessary, in order to eliminate a deficit.

The Solenoid Shut Pulses parameter applies only to the Pulser Input additive method. Its purpose is to compensate for the closing speed of the solenoid valve, which may allow a slight, but consistent over-delivery of additive (non-cumulative). Compensation is accomplished on a pulse basis rather than a volumetric basis. This feature is intended to eliminate the remaining over-delivery, assuming mechanical adjustments to the solenoid valve's closing speed have already been made. The quantity of pulse overruns due to valve action can be determined by performing the Additive Calibration test or the Additive Diagnostic Test Injection. The quantity of excess pulses delivered for each test injection can be observed. When the number of overrun pulses is determined, enter the number into this parameter to further reduce the overrun. (See the Additive Calibration topic later in this chapter for details.)

6.5.6 CONFIGURING A PULSER INPUT ADDITIVE

This topic describes the minimum configuration needed to get an additive to operate using this method. Configuration of the following parameters is mandatory. You can accomplish this using the MultiLoad II Configuration Tool or the MultiLoad II keypad in Program mode. Select the preset and additive desired.

Additive Enable	Enable this parameter.
Flow control module #	Set this value to the FCM # where the additive is connected. Set this value to zero for the internal I/O board.
FCM Port #	Select the port that will serve as the Additive Injection Output. Note: A corresponding additive input port will automatically be assigned. See the Additive Port Assignment description above.
Additive Type	Set this value to 'SolnMtr', Multiload will control the solenoid to inject and meter the pulses.
Additive Volume Per Injection	Enter the injection volume in the appropriate units.
Piston Throw Time	This parameter is not applicable.
Additive Meter K-Factor	Enter the additive meter's K-factor in pulses per gallon.

The remaining parameters that apply to this additive method are optional. They are used to set up alarming, pump outputs and permissive inputs. Some of the remaining parameters affect how the additive is delivered at different stages of the load cycle. All Additive configuration screens and parameter descriptions are found in the 'General Additive Setup' section that follows.

The "Parameters for Additive Methods" table lists the parameters that apply to this method.

6.5.7 METHOD 4 – ANALOG ADDITIVE

This configuration assumes that a flow measurement device is metering the amount of additive entering the product stream. It is assumed that there is no piston/cylinder and that the additive output port (4 – 20mA) is commanding a drive of a pump, which controls the delivery of additive. Instead of incrementing the additive totalizer at each injection or upon receipt of a feedback signal, this feature updates the additive totalizers based upon measured flow.

Because the physical limitations of a piston/cylinder injector are eliminated, the Throw Time parameter is irrelevant. The Volume Per Injection parameter is still valid, however. The Volume Per Injection parameter sets a target pace that the system will inject, if necessary, in order to eliminate a deficit. To control better the drive of the pump a PID loop is implemented. All three parameters can be changed to get a stay drive of the pump during loading.

The Solenoid Shut Pulses parameter applies only to the Pulser Input additive method. The quantity of pulse overruns due to valve action can be determined by performing the Additive Calibration test or the Additive Diagnostic Test Injection. The quantity of excess pulses delivered for each test injection can be observed. When the number of overrun pulses is determined, enter the number into this parameter to further reduce the overrun. (See the Additive Calibration topic later in this chapter for details.)

6.5.8 CONFIGURING A ANALOG ADDITIVE

This topic describes the minimum configuration needed to get an additive to operate using this method. Configuration of the following parameters is mandatory. You can accomplish this using the MultiLoad II Configuration Tool or the MultiLoad II keypad in Program mode. Select the preset and additive desired.

Additive Enable	Enable this parameter.
Flow control module #	Set this value to the FCM # where the additive is connected. Set this value to zero for the internal I/O board. This should be always a flow fcm2, because the only fcm who has an analog output.
FCM Port #	Select the port that will serve as the Additive Injection Output. Note: A corresponding additive input port will automatically be assigned. See the Additive Port Assignment description above.
Additive Type	Set this value to ‘AnlgMtr’. Multiload will control the pump speed to inject continues the additive into the main line. Feedback we receive via the pulser of the additive.
Additive Volume Per Injection	Enter the injection volume in the appropriate units.
Piston Throw Time	This parameter is not applicable.
Additive Meter K-Factor	Enter the additive meter's K-factor in pulses per gallon.

The remaining parameters that apply to this additive method are optional. They are used to set up alarming, pump outputs and permissive inputs. Some of the remaining parameters affect how the additive is delivered at different stages of the load cycle. All Additive configuration screens and parameter descriptions are found in the ‘General Additive Setup’ section that follows.

The “Parameters for Additive Methods” table lists the parameters that apply to this method.

6.5.9 METHOD 5 – COMMON METER WITH MULTIPLE ADDITIVES

Method 4 permits multiple additives to be delivered through a common injector.

The injector must use an additive meter that provides a pulsed output to a Flow Control Module. This method of additive metering is an extension of the Pulse Input approach (Method 3). The principles described in Method 3 apply to this method, also.

A maximum of 16 additives (2 additives on SMP) can be routed through a single injector. Regardless of the configuration, a maximum of 16 additives (2 additives on SMP) can be assigned to each load arm; only one additive can be delivered through the common injector during a single load.

The Common Meter algorithm has been designed to accommodate two hydraulic configurations: One scheme employs an Injector Valve and Additive Block Valves. The second scheme uses Additive Block Valves only.

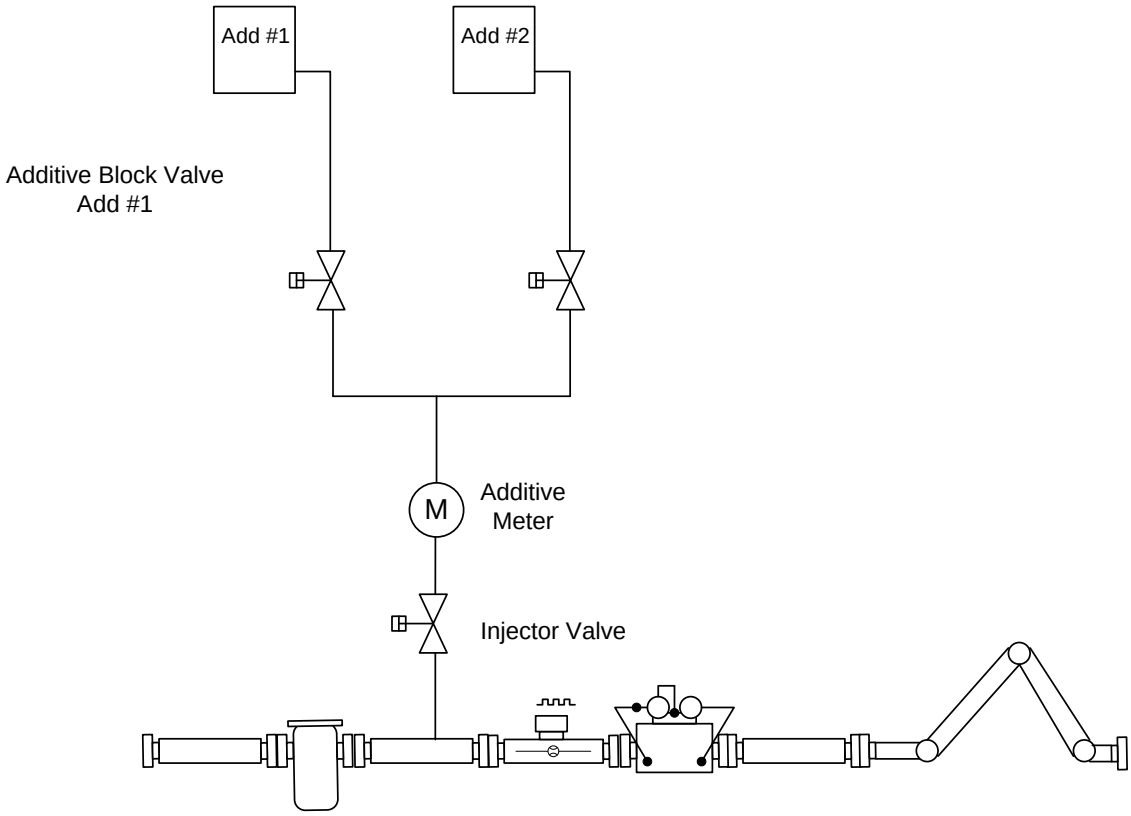


Figure 6.3 Common Injector Valve Scheme

In the diagram above, the solenoid-operated Additive Block Valves are used to select the additive that is to be delivered. One of these valves will open when the start button is pressed. It will close when the additive quantity required for the entire load has been delivered.

While loading, the Additive Injector Valve opens and closes periodically to inject additive into the product stream. The Additive Injector Valve will be open long enough to deliver the quantity specified by the Additive Volume per Injection parameter.

The following schematic illustrates the electrical relationship between the injection outputs and the solenoid operated valves. The outputs are represented by switches in the diagram. During a load, only one of the Additive Block Valve outputs will be active. The output will remain active, energizing its corresponding solenoid for the load's duration. The Additive Injection output will close and open periodically as injections are required, energizing and de-energizing the injector solenoid.

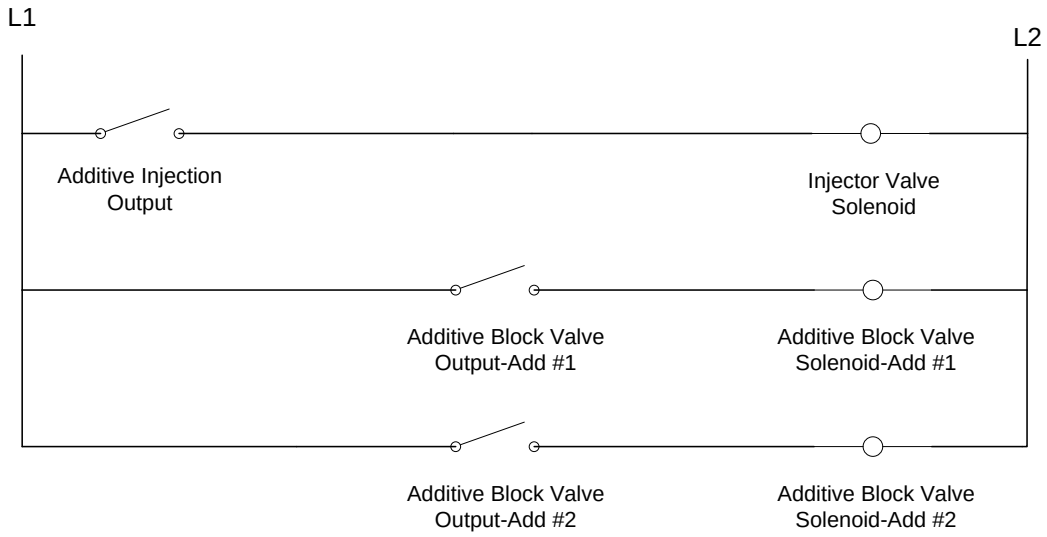


Figure 6.4 Electrical Schematic using Injector Valve

6.5.10 ADDITIVE BLOCK VALVES ONLY

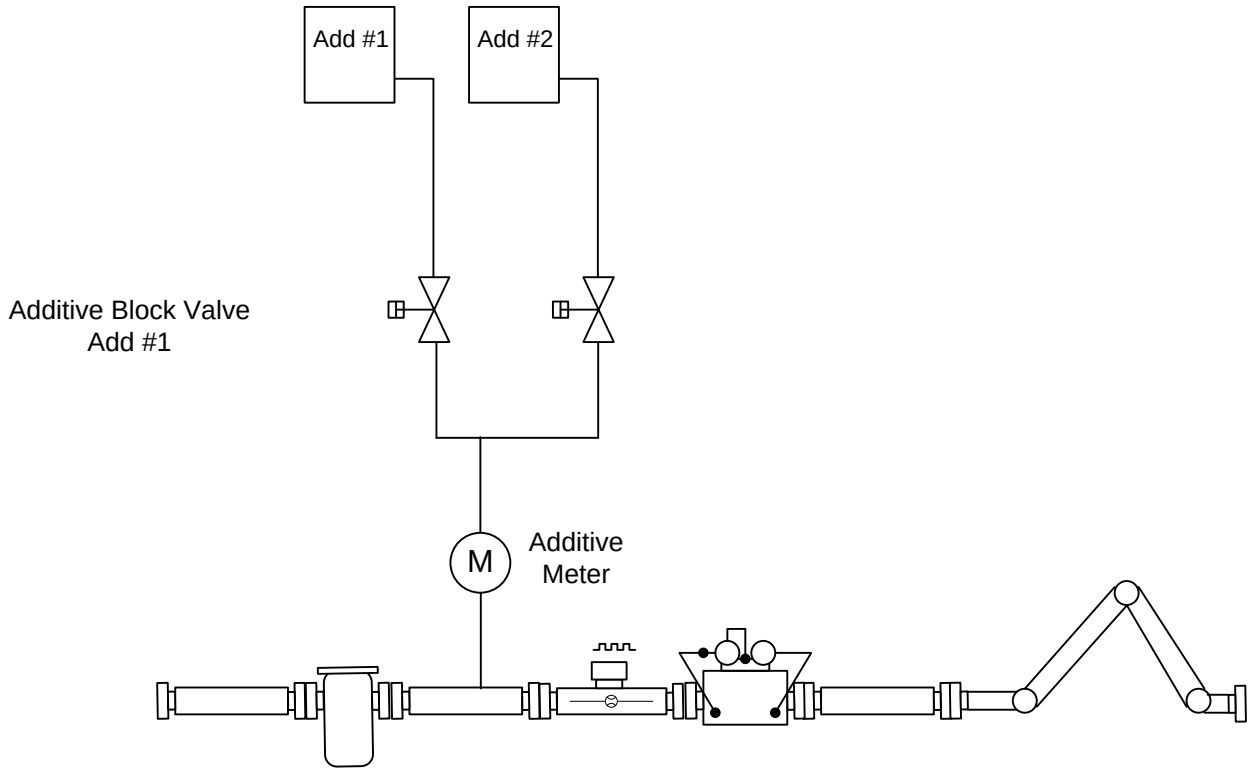


Figure 6.5 Scheme using Block Valves to Inject

In the diagram above, the solenoid-operated Additive Block Valves are used to select the additive that is to be delivered. In contrast to the previous scheme, an additive Injector Valve is not used. During a load, the Additive Block Valve of the selected additive is opened only when an injection is commanded. This is accomplished by wiring the Additive Block Valve output in series with the Additive Injection output. Refer to the schematic below.

During a load, the selected Additive Block Valve output will be active at all times. The Additive Injection output will periodically complete the circuit, energizing the Additive Block Valve solenoid, whenever an injection is commanded.

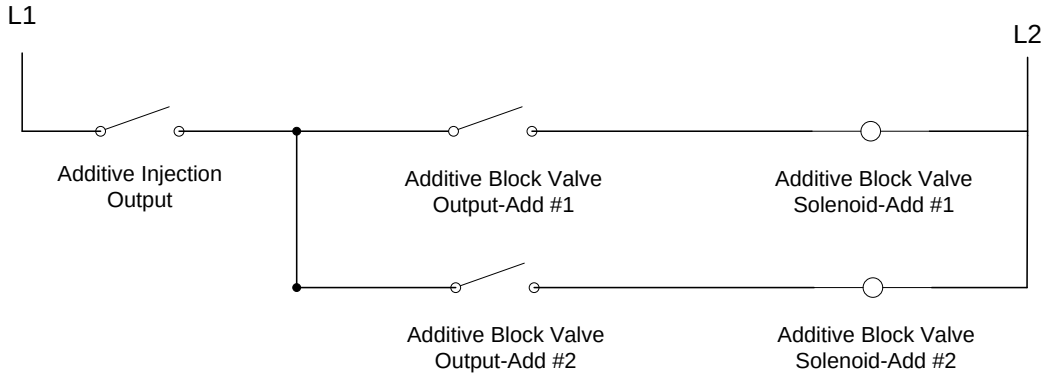


Figure 6.6 Electrical Schematic using Block Valves as Injectors

6.5.11 CONFIGURING A COMMON METER WITH MULTIPLE ADDITIVES

This topic describes the minimum configuration needed to get an additive to operate using this method. Configuration of the following parameters is mandatory. You can accomplish this using the I/O II Configuration Tool or the I/O II keypad in Program mode. These parameters will have to be configured for each additive that is assigned to the common injector.

Additive Enable	Enable this parameter.
Flow control module #	Set this value to the FCM # where the additive is connected. Set this value to zero for the internal I/O board.
FCM Port #	Select the port that will serve as the Additive Injection Output. Note: A corresponding additive input port will automatically be assigned. See the Additive Port Assignment description above.
Additive Type	SolnMtr/AnlgMtr
Additive Volume Per Injection	Enter the injection volume in appropriate units.
Piston Throw Time	This parameter is not applicable.
Additive Meter K-Factor	Enter the additive meter's K-factor in pulses per gallon.
Open Block Valve FCM#	Assign an output port that will provide an output to open an Additive Block Valve. The Additive Block Valve will be used for additive selection.

The remaining parameters that apply to this additive method are optional. They are used to set up alarming, pump outputs and permissive inputs. Some of the remaining parameters affect how the additive is delivered at different stages of the load cycle. All Additive configuration screens and parameter descriptions are found in the 'General Additive Setup' section that follows. The "Parameters for Additive Methods" table lists the parameters that apply to this method. Not all of the additive parameters are applicable to every additive delivery method. The following table shows the parameters that apply to each of the four possible methods. "Yes" indicates that the parameter applies to the additive method. "No" indicates that the parameter does not apply to the method.

	Piston Only	**Piston w/Input**	**Pulser Only**	**Common Meter**	**Analog**
Add. Enable	Enabled*	Enabled*	Enabled*	Enabled*	Enabled*
Add. FCM#	Yes*	Yes*	Yes*	Yes*	Yes*
FCM Port (output)	Yes*	Yes*	Yes*	Yes*	Yes* (4 – 20mA)
W&M Controlled	Yes	Yes	Yes	Yes	Yes
Upstream Block Valve	Yes	Yes	Yes	Yes	Yes
Additive Type	Pstn	PstnNFB/PstnIFB	SolnMtr	SolnMtr/AnlgMtr	AnlgMtr
Additive P Factor	No	No	No	No	Yes
Additive I Time	NO	No	No	No	Yes
Additive D Time	No	No	No	No	Yes
Sol. Shut Pulses	No	No	Yes	Yes	No
Shutoff Vol. End	Yes	Yes	Yes	Yes	Yes

	Piston Only	Piston w/Input	Pulser Only	Common Meter	Analog
Last Inj. Vol. End	Yes	Yes	Yes	Yes	Yes
Line Flush Min. Vol.	Yes	Yes	Yes	Yes	Yes
W&M Recipe Percentage	Yes	Yes	Yes	Yes	Yes
Add. Vol per Inj.	Yes*	Yes*	Yes*	Yes*	Yes
Vol./Inj. Cal factor	Yes	Yes	No	No	Yes
Add. K-Factor	No	No	Yes*	Yes*	Yes
Add. Meter Factor	No	No	Yes	Yes	Yes
Max Pstn Missed Inj	No	Yes	No	No	No
Max Solenoid Inj Time	No	No	Yes	Yes	Yes
Under Add. Inj #	Yes	Yes	Yes	Yes	Yes
Over Add. Inj. #	Yes	Yes	Yes	Yes	Yes
Check Add. Tol.	Yes	Yes	Yes	Yes	Yes
UA Flow Alm Vol	No	Yes	Yes	Yes	Yes
Valve Fault Vol.	No	Yes	Yes	Yes	Yes
Over Inject Vol.	Yes	Yes	Yes	Yes	Yes
Creep Reset Time	No	No	Yes	Yes	Yes
Unauth Reset Time	No	No	Yes	Yes	Yes
Max Pstn Throw Time	Yes*	Yes*	No	No	No
Pump Status Alm.	Yes	Yes	Yes	Yes	Yes
Meter Creep Alm. Vol	No	No	Yes	Yes	Yes
Remote Calibrate	Yes	Yes	Yes	Yes	Yes

	Piston Only	Piston w/Input	Pulser Only	Common Meter	Analog
BV Open Alrm Time	Yes	Yes	Yes	Yes	Yes
BV Close Alrm Time	Yes	Yes	Yes	Yes	Yes
Pump Stop Delay	Yes	Yes	Yes	Yes	Yes
Flush Pump Run Time	Yes	Yes	Yes	Yes	Yes
Meter Flushed	No	No	Yes	Yes	Yes
Solenoid Flushed	No	No	Yes	Yes	Yes
W&M Alarm Promo Count	No	Yes	Yes	Yes	Yes
W&M Alarm Reset Mode	No	Yes	Yes	Yes	Yes
Flush Pump Run FCM#	Yes	Yes	Yes	Yes	Yes
Close Blk Val FCM#	Yes	Yes	Yes	Yes	Yes
Blk Val Status FCM#	Yes	Yes	Yes	Yes	Yes
Open Blk Val FCM#	Yes	Yes	Yes	Yes*	Yes
Test Button FCM#	Yes	Yes	Yes	Yes	Yes
Pump Run FCM#	Yes	Yes	Yes	Yes	Yes
Pump Kill FCM#	Yes	Yes	Yes	Yes	Yes
Pump Stat FCM#	Yes	Yes	Yes	Yes	Yes
Alarm Out FCM#	Yes	Yes	Yes	Yes	Yes
Authorized FCM#	Yes	Yes	Yes	Yes	Yes
Permiss FCM#	Yes	Yes	Yes	Yes	Yes
Permiss Out FCM#	Yes	Yes	Yes	Yes	Yes

* Configuration of this parameter is mandatory

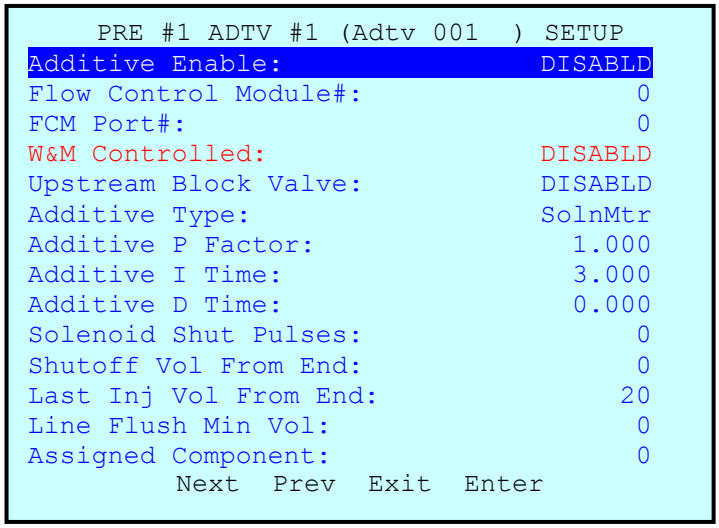
6.6 GENERAL ADDITIVE SETUP

1. From Program mode, select Configuration | Equipment Setup.
2. From the Equipment Setup Menu, select **Additives**.

   The Select Preset menu displays.
3. Select a preset.

   The Select Additive – Preset# screen displays.
4. Select an additive.

   The Additive Setup screen displays.


PRE #1 ADTV #1 (Adtv 001) SETUP
Additive Enable: DISABLD
Flow Control Module#: 0
FCM Port#: 0
W&M Controlled: DISABLD
Upstream Block Valve: DISABLD
Additive Type: SolnMtr
Additive P Factor: 1.000
Additive I Time: 3.000
Additive D Time: 0.000
Solenoid Shut Pulses: 0
Shutoff Vol From End: 0
Last Inj Vol From End: 20
Line Flush Min Vol: 0
Assigned Component: 0
Next Prev Exit Enter

Parameter	Description
Additive Enable	Enables or disables the selected additive.
Flow Control Module#	Set this value to the FCM # where the additive is connected. Set this value to zero for the internal I/O board.

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>FCM Port#</td><td>Choose the port that will serve as the additive injection (output) signal for the selected additive. Possible choices are 0-3 (0-1 on SMP). This port choice also automatically chooses a port to serve as either the additive meter input or the additive feedback signal.
The following list shows which additive meter input/injector feedback input corresponds to what additive port.
Additive Port Additive Meter/Injector Feedback Input
<table>
<tr><th></th><th>Output Port</th><th>Input Port</th></tr>
<tr><td>Injector #1</td><td>0</td><td>7</td></tr>
<tr><td>Injector #2</td><td>1</td><td>6</td></tr>
<tr><td>Injector #3 (Excluding SMP)</td><td>2</td><td>5</td></tr>
<tr><td>Injector #4 (Excluding SMP)</td><td>3</td><td>4</td></tr>
</table>
For example, if Additive Port #0 is chosen, the additive solenoid will be energized by the port 0 output and the additive meter input signal will be expected at port 7. If a calibrated cylinder is used with no additive meter, a feedback signal can be sent to port 7 to verify that the piston has completed the injection cycle.</td></tr>
<tr><td>W&M Controlled</td><td>Enables select additive parameters for this additive to be under W&M control.</td></tr>
<tr><td>Upstream Block Valve</td><td>Enable this parameter if the additive block valve is upstream of the injector. When enabled, the additive block valve will be opened during additive calibration.</td></tr>
<tr><td>Additive Type</td><td>Choose the type of additive control to use, which is one of:
SolnMtr – Solenoid with meter
PstnNFB – Piston with normal feedback
PstnIFC – Piston with inverted feedback
Pstn – Piston with no feedback
AnlgMtr – Analog valve with meter with PID control</td></tr>
<tr><td>Additive P Factor</td><td>Proportional gain for PID loop (only applies to analog valve additive type)</td></tr>
<tr><td>Additive I Time</td><td>Integral gain for PID loop (only applies to analog valve additive type)</td></tr>
<tr><td>Additive D Time</td><td>Derivative term for PID loop (only applies to analog valve additive type)</td></tr>
<tr><td>Solenoid Shut Pulses</td><td>This parameter applies only to the Pulser additive method. Its purpose is to compensate for the closing speed of the solenoid valve, which may allow consistent over-deliveries. Compensation is accomplished on a pulse basis rather than a volumetric basis. This feature is intended to eliminate the remaining over-delivery, assuming mechanical adjustments to the solenoid valve's closing speed have already been made. The quantity of pulse overruns due to valve action can be determined by performing the additive calibration test. The quantity of excess pulses delivered for each test injection can be observed. When the number of overrun pulses is determined, enter the number into this parameter to eliminate the overrun.</td></tr>
<tr><td>Shutoff Vol From End</td><td>Additive will stop delivery at the remaining preset quantity specified by this parameter. Enter a numerical value in the units of volume used by the base components. When the remaining quantity of the load reaches the volume specified in this parameter, delivery of the selected additive will cease, regardless of the amount of additive demand that remains. This is typically done to allow the additive to be flushed from the load arm by the time product delivery is complete. If additive injection is desired throughout the entire delivery, enter a zero for this parameter. See descriptions of the related parameters entitled, Last Injection Volume From End and Line Flush Minimum Volume.</td></tr>
</table>

Parameter	Description
Last Inj Vol From End	Last Injection Volume From End. This parameter specifies when the last injection should occur, in order to deliver the proper additive volume, based on the preset quantity. With the use of this parameter, it is possible to have the load arm flushed of additive as described in the Shutoff Vol From End parameter, but still maintain a proper additive/product ratio throughout most of the delivery. When the last injection is initiated, the remaining additive requirement will be delivered as quickly as possible before the Shutoff Volume From End volume is reached. *Example:* We have a preset quantity of 1000 gallons and we want the additive to be finished delivering by the time we reach the last 50 gallons of the batch, in order to flush the load arm of additive. The Shutoff Vol From End parameter has been set to 50 gallons, commanding the additive to be finished by this point in the delivery. If we set the Last Injection Volume From End parameter to 100 gallons, additive will be injected at a rate that will ensure a proper additive ratio at any time before the last 100 gallons is delivered. If the batch is aborted at the 500 gallon mark, the driver will have a properly additized load. When the batch reaches the final 100 gallon mark, the system knows that it has to have the remaining additive delivered before the final 50 gallon mark is reached. The rate of injection is substantially increased to satisfy the requirement for the load. As a result, the batch is over additized for a short time as the last 100 gallons is delivered. When the last gallon has been delivered, the batch is properly additized. *Even if additive line flush is not a consideration, it is recommended that this parameter be set to the default value of 20 gallons, which will ensure a precise delivery of additive.*
Line Flush Min Vol	Specifies the volume of product line flush that must occur to satisfactorily flush additive from the load arm. Enter the value in the volumetric units used by the product flow meter. After the additive has completed delivery, the volume entered in this parameter must pass through the product flow meter. If the volume indicated in this parameter does not get delivered after the additive requirement for the load has been met, an additive flush alarm will occur. Enter a zero in this parameter to disable the feature. This feature has no bearing on the settings of the flush parameters that are found in the Preset menu.
Assigned Component	If an additive is injected into a particular component of a sequential blend, all additive volume for the batch must be delivered when this component is flowing. This parameter, when non-zero, specifies that the additive can only flow when the specified component is flowing.
W&M Recipe Percentage	If this additive is to have the recipe percentage under W&M protection, set this value to the W&M accepted value. When this value is non-zero, the Additive Recipe Percentage MUST be equal to the W&M Recipe Percentage or all attempts to authorize a batch will be denied displaying a message of “W&M Required Additive Pct Not Correct”.
Additive Vol/Inject	The Additive Volume per Injection parameter is applicable to all additive methods. When using a piston system, with or without feedback, enter the volume of the calibrated cylinder as indicated by the manufacturer or calibration service. When the additive method involves a piston and an additive flow meter pulser, enter the cylinder size. If an additive flow meter pulser is used, enter the volume of additive desired for each injection. Enter the value using the same units of volume as the K-Factor of the main product flow meter. Do not use CCs.
Vol/Inject Cal Factor	This factor will correct the calibrated cylinder volume to a gross observed volume, as actually measured during the additive calibration process. When an additive meter is involved, with or without a piston system, set the parameter to 1.0000.
Additive Mtr K-Factor	Enter the K-factor of the additive flow meter. This parameter is applicable if using an additive flow meter with or without a piston injector. Enter the value using the same units of volume as the K-Factor of the main product flow meter. Do not use CCs.

Parameter	Description
Additive Meter Factor	This is the meter factor for the additive flow meter that will be used to correct the metered results to the observed additive volume. The observed additive volume is obtained during additive meter calibration.
Max Pstn Missed Inj	Use the parameter when employing the Piston With Input method of additive delivery. Enter the number of piston injections that can be missed before the system raises the Injection Fault alarm. The alarm will be raised if the specified quantity of missed injections occurs sequentially or if the quantity of missed injections accrues before the preset quantity has been delivered.
MaxSolenoid Inj Time	This parameter defines the amount of time that the solenoid valve will remain open during an injection. If no pulses are received within the specified time period, an INJCT FLT (injection fault) alarm will occur. It may then be necessary to check the operation of the pulser. Enter a time in seconds. If the injections are of a longer duration than the default setting of this parameter, it will be necessary to increase the time to be greater than the typical injection time. It may be necessary to increase the default value when front loading additive or when the additive lines flush requires one final, large injection.
Under Add Alrm # Inj	Under Additize Alarm # of Injections. When the product becomes under additized by the number of injections specified in this parameter, an additive alarm will be raised and delivery will stop. The volume of each injection is determined in parameter Additive Vol/Inj.
Over Add Alrm # Inj	Over Additized Alarm # of Injections. When the product becomes over additized by the number of injections specified in this parameter, an additive alarm will be raised and delivery will stop. The volume of each injection is determined in parameter Additive Vol/Inj.
Check Add Tol Time	Set the Check Additive Tolerance Time to permit the system ample time to recover from an Under Additized or Over Additized alarm condition. If this value is set too low, the system will continue to go into the referenced alarm conditions until the additive error has been reduced to within the # of injections specified by the Additized Alarm parameters. Enter a value in units of time (seconds).
Unauth Flow Alrm Vol	Specify the volume of Unauthorized Additive Flow that will have to accumulate before an additive's Unauthorized Flow Alarm is activated. ⚐ This parameter does not apply to the non-Pulser methods.
Valve Fault Alrm Vol	Specify the volume of additive flow that will have to accumulate before an additive's Valve Fault Alarm is activated. The alarm occurs when an additive is authorized for use and is flowing, but the system has not commanded additive to flow. This is the only alarm condition that will cause the additive pump to stop. ⚐ This parameter does not apply to the non-Pulser methods.
Over Inject Vol	The intent of this parameter is to ensure, in all cases where a load is aborted, that additive delivery will be ahead of schedule. Upon starting a load, a number of injections will occur immediately. The number of injections that will occur immediately is dependent on the number entered for this parameter. If a value of one is entered, a single injection will occur as soon as Start is pressed. Throughout the remainder of the load, a one-injection surplus will be maintained. Upon reaching completion, the volume of additive delivered will be 100% of the specified volume, plus the volume of one injection. If a load is terminated prematurely, it will have the proper additive volume for the amount of product delivered, plus a volume between 0.5 to 1.0 injections. Valid range of entries is 1.0 to 65. See figure 6.7.

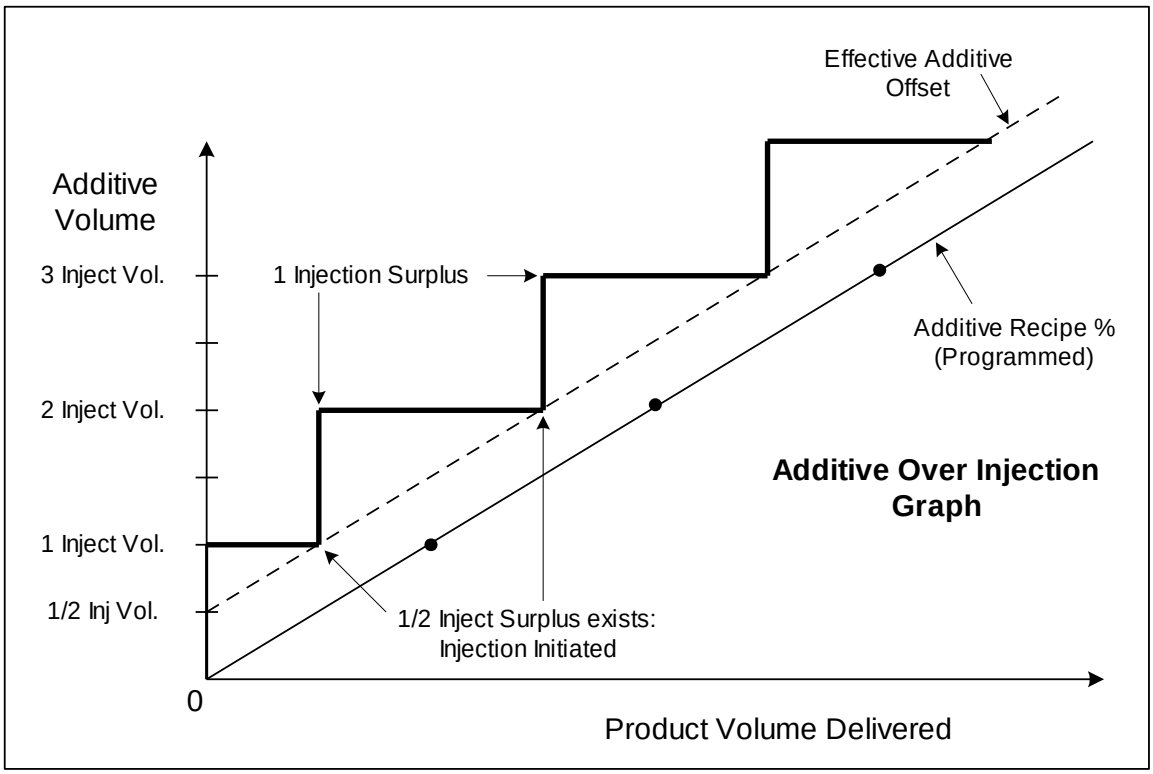


Figure 6.7 Additive Over Injection

Parameter	Description
Creep Reset Time	Additive Meter Creep is any volume that passes the additive meter when the valve is commanded to be shut. Creep volumes can occur when the additive is authorized or unauthorized (see 'Unauth Reset Time' parameter description). A small amount of meter creep due to line shock is expected. Flow does not necessarily occur, but slight meter movement due to line shock will cause the system to view it as such. Over time, the accumulated creep volume may increase to a value that raises an alarm (meter creep or valve fault). To avoid nuisance alarms, this accumulated value must be periodically reset. The Creep Reset Time parameter specifies the reset interval in seconds. If the volume of meter creep specified in the Meter Creep Alarm Volume occurs within the time set by this parameter, a Meter Creep alarm will occur. This function does not reset the viewable Creep Totalizer that is found in the Additive Views & Inquiry's screen.
Unauth Reset Time	Unauthorized (flow) Reset Time: Additive Unauthorized Flow is any volume that passes the additive meter when the additive is not authorized. A small amount of unauthorized flow detection due to line shock is expected. Flow does not necessarily occur, but slight meter movement due to line shock will cause the system to view it as such. Over time the accumulated unauthorized volume may increase to a value that raises an alarm (unauthorized flow). To avoid nuisance alarms this accumulated value must be periodically reset. The Unauthorized Reset Time parameter specifies the reset interval in seconds. If the volume of Unauthorized Flow specified in the Unauthorized Flow Volume parameter occurs within the time period specified by Unauth Reset Time, an Unauthorized Flow alarm will activate. This function does not reset the Unauthorized Flow totalizers that can be viewed in the Additive Views & Inquiry's screen.
Max Piston Throw Time	When piston injectors are employed, this parameter tells the additive control logic how much time to permit the injector to complete each injection stroke.

Parameter	Description
Pump Start Alrm Time	If a Pump Status signal has not been received from the additive pump in the time specified by this parameter, the additive's Pump Status Alarm will be raised. Enter the time in seconds. To disable this alarm enter zero.
Meter Creep Alrm Vol	Enter the volume of meter creep that will trigger a Meter Creep alarm. If the volume of meter creep specified in this parameter accumulates within the time period indicated in the Creep Reset Time parameter, a Meter Creep alarm will occur. Meter creep may indicate that there is a small leak in the valve or it may be the result of excessive line shock. Meter creep means that fluid is moving past the meter when the valve is supposed to be closed.
Remote Calibration	Enable this parameter if it is desired to have the selected additive enabled on the Remote Additive Calibration selection list. This parameter is only relevant if the Remote Additive Calibration feature is to be used and remote additive test buttons have been installed.
B.V. Open Alrm Time	Block Valve Open Alarm Time. This parameter specifies the time in seconds to allow the additive's block valve to open. If an additive block valve employs a feedback signal, an alarm will occur if the feedback requirement is not satisfied in this time. If a feedback signal is not used and the value of this parameter is greater than zero, the opening of the block valve will be delayed until the Block Valve Open Alarm Time has elapsed.
BV Close Alrm Time	Specifies the time in seconds to allow the additive's block valve to close. If an additive block valve employs a feedback signal, an alarm will occur if the feedback requirement is not satisfied in this time.
Pump Stop Delay	Enter the time, in seconds, for the additive pump to continue running after batch completion. When this parameter is set to zero seconds, the pump keeps running until the batch is complete; in most configurations additive delivery will be finished prior to batch completion in order to accommodate an additive flush of the product line. If more than one load arm is placing a demand on the additive pump contact, that contact will remain active as long as a load arm is calling for the additive.
Flush Pump Run Time	The Flush Pump signal is intended to run a pump that is designed to flush the orifice of a block valve. The block valve and Flush Pump are typically used for red dye applications. The Flush Pump signal will activate when the dye requirement has been delivered and the block valve has been commanded to close. The Flush Pump will run for a period specified by this parameter. Enter a value in seconds.
Meter Flushed	This parameter is to be enabled if the additive meter is in the flush path. When enabled, additive meter pulses will be ignored during a period specified by the Flush Pump Run Time. Consult the User Guide for more details on performing additive flush on this type of additive configuration. See also Solenoid Flushed parameter description.
Solenoid Flushed	This parameter is to be enabled if the additive Injector Valve is in the flush path. The additive Injector Valve will be held open during a period specified by the Flush Pump Run Time. Consult the User Guide for more details on performing additive flush on this type of additive configuration.
W&M Alarm Promo Count	If this additive is to have a W&M clear promotion level, setting this value to a non-zero number will override the value in the Additive Alarm Setup configuration..
W&M Alarm Reset Mode	If the W&M Alarm Promo Count is non-zero, then for this additive, this value will override the value in the Additive Alarm Setup configuration..
Flush Pump Run FCM#	This parameter permits selection of an output port that will provide an output signal to activate a flush pump.

Parameter	Description
Close Blk Val FCM#	Close Block Valve FCM#. This parameter permits selection of a port that will provide an output signal to close an additive's block valve. The valve is commanded to close when the remaining quantity of the load reaches the value specified in the additive parameter Shutoff Volume From End. The block valve is commanded to close at this volume in order to permit the additive or dye to be flushed from the line.
Blk Val Status FCM#	Block Valve Status FCM#. This parameter allows the selection of a port that will receive an input signal. The input signal will represent the state of the additive block valve, indicating whether it is open or closed. When the block valve is closed, an external contact attached to the valve will close, applying a status signal to the input. When the block valve is open, the external contact will also be open, removing the status signal from the input. When the block valve has been commanded to open, the absence of a signal at the input will indicate that the valve has opened. If the "closed" signal is still present after the Block Valve Open Delay time has elapsed, a block valve failure alarm will be issued. When the block valve has been commanded to close, the presence of the status signal at the input will indicate that the valve has closed. If the "closed" signal has not been detected by the time the Block Valve Close Delay time has elapsed, a block valve failure alarm will be issued.
Open Blk Val FCM#	Open Block Valve FCM#. This parameter permits selection of a port that will provide an output signal to open an additive's block valve. This output will provide a signal to open the block valve as soon as the Start button is pressed. The signal will be removed when the remaining quantity of the load reaches the value specified in the additive parameter Shutoff Volume From End. The signal is removed at this volume in order for the valve to close and to permit the additive or dye to be flushed from the line. When MultiLoad II commands the valve to close, the Open Blk Val signal will be removed.
Test Button FCM#	This parameter allows the selection of a port that will receive an input signal for the test injection button used during calibration.
Pump Run FCM#	Permits the selection of a port that will provide an output signal to run the additive pump.
Pump Kill FCM#	Permits the selection of a port that will provide an output signal to stop the additive pump. The Pump Kill signal only becomes active when the system experiences an additive Valve Fault Alarm.
Pump Status FCM#	Permits the selection of a port that will accept an input signal that will verify if the additive pump is running or not. If this signal is absent for the period specified in the Pump Status Alarm Time parameter, the additive's Pump Status Alarm will be raised.
Alarm Out FCM#	Provides an output signal if the additive has an active alarm. This parameter selects an output port that will be assigned to signal an additive level alarm condition.
Authorized FCM#	Provides an output signal if the additive has been authorized for flow as a result of driver card-in. This parameter selects an output port that will be assigned to signal the condition.
Permiss FCM#	Permiss FCM# parameter allows the selection of a port that will receive an input signal. The input signal will represent the state of the additive's permissive. If the signal is not present at authorization or if the signal is lost during delivery, the process will be stopped and a permissive additive level alarm will be raised.
Permiss Out FCM#	This parameter permits the selection of a port that will provide an output signal. The signal will indicate that all additive permissive requirements have been met.

6.7 ADDITIVE CALIBRATION

Two additive calibration methods are available with the MultiLoad II. One is called Additive Cal, which addresses one additive at a time. The other is Remote Calibration, which permits simultaneous setup of multiple additives for calibration. The Remote Calibration function is discussed following the section on the standard Additive Calibration function.

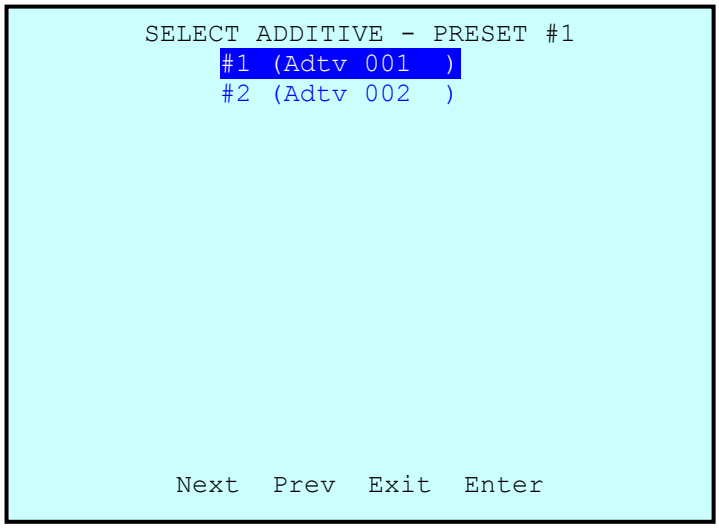
6.7.1 ADDITIVE CAL. FUNCTION

The standard Additive Cal(ibration) feature enables the user to calibrate one additive at a time. The test injections can be initiated by an optional pushbutton installed at the additive panel, or the test injections can be initiated by pressing a button on the MultiLoad II keypad.

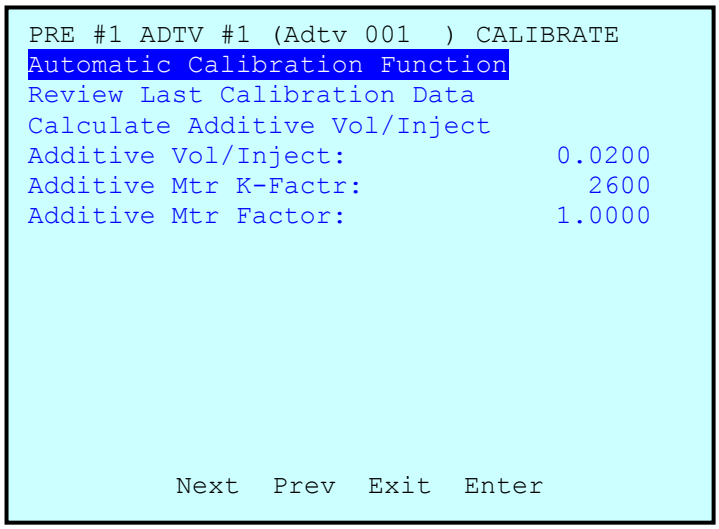
To use a pushbutton configure the additive parameter Test Button FCM# to indicate the input port that is connected to the pushbutton. If the Test Button FCM# parameter is disabled, the system will expect a button press from the MultiLoad II keypad.

To start the Additive Calibration procedure:

1. From the Configuration Menu, choose **Additive Cal**.
2. The Select Additive screen displays:
3. Choose the desired Additive.



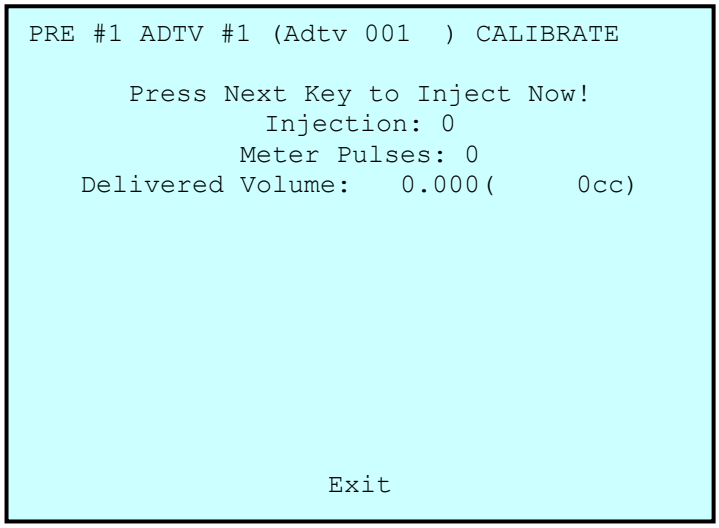
4. The Additive Calibrate screen displays for the selected additive:


PRE #1 ADTV #1 (Adtv 001) CALIBRATE
Automatic Calibration Function
Review Last Calibration Data
Calculate Additive Vol/Inject
Additive Vol/Inject: 0.0200
Additive Mtr K-Factr: 2600
Additive Mtr Factor: 1.0000
Next Prev Exit Enter

6.7.2 AUTOMATIC CALIBRATION FUNCTION

The following screen samples reflect standard Additive flow meters. The screens for Piston type meters are slightly different. The sequence demonstrates injections that are initiated at the MultiLoad II.

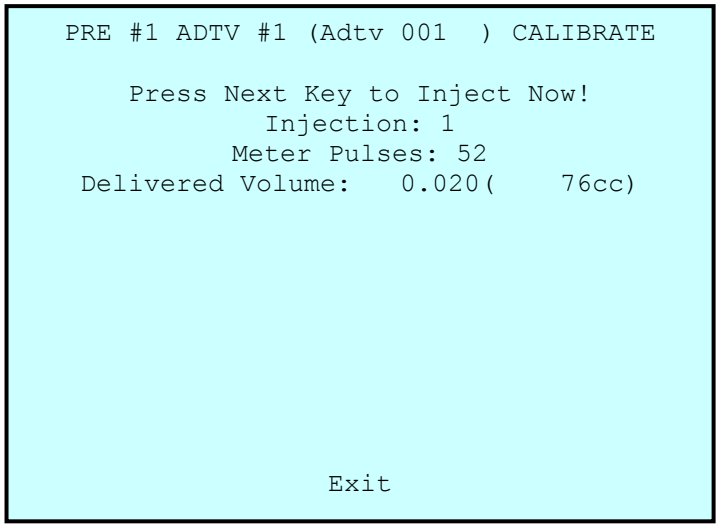
1. From the Additive Calibrate screen, choose **Automatic Calibration Function**.
2. The Calibrate Additive screen displays.



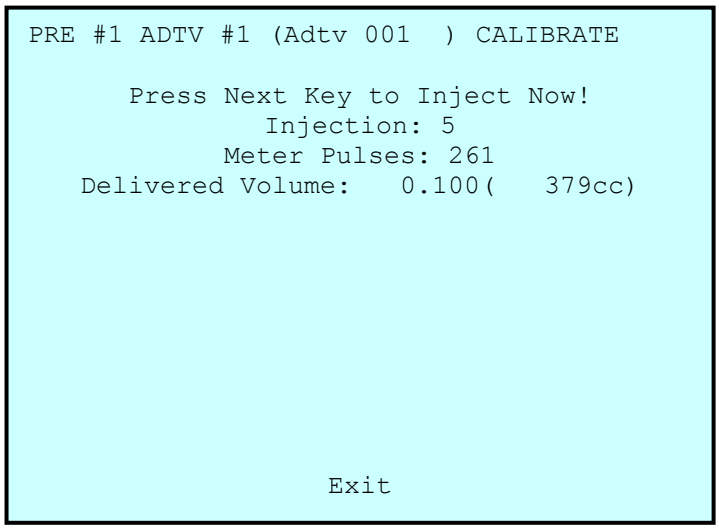
(Note: If the Test Button is Enabled, the text 'Hold Test Button To Inject Now!' would appear instead of 'Press NEXT Key to Inject Now!')

3. Place the test beaker to collect the additive injections and open the test port on the injector.
4. Press the NEXT key, or press the test button.
5. The first injection is made.

6. The number of meter pulses displays, as well as the delivered volume in gallons and in CCs (in parentheses).

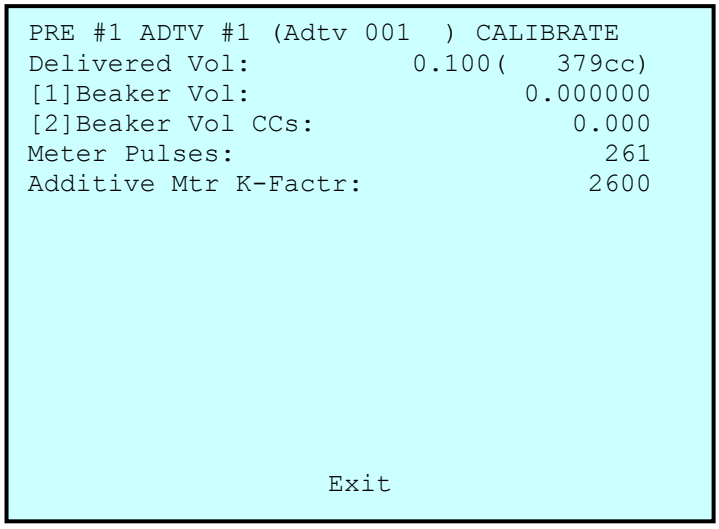


7. Press the **NEXT** key again to get another injection. Continue to inject until you have enough volume in the beaker to get a measurable reading.

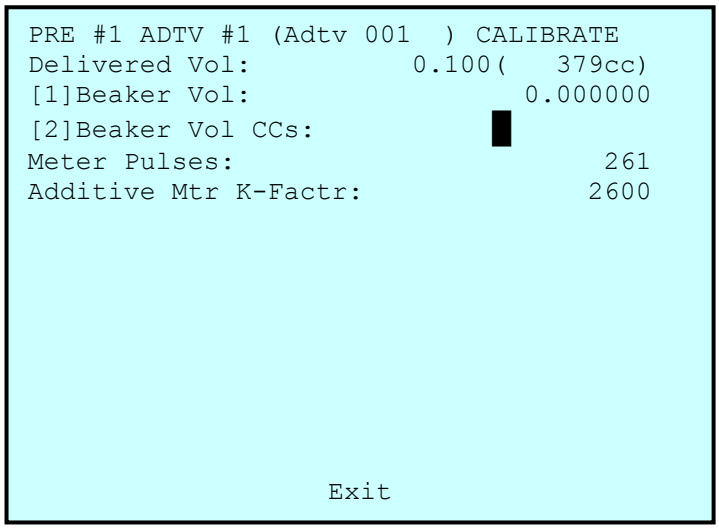

PRE #1 ADTV #1 (Adtv 001) CALIBRATE
Press Next Key to Inject Now!
Injection: 5
Meter Pulses: 261
Delivered Volume: 0.100(379cc)
Exit

8. Record the volume collected in the beaker.
9. Press **EXIT**.

10. A ‘Please Wait’ message displays briefly, then the following screen displays:

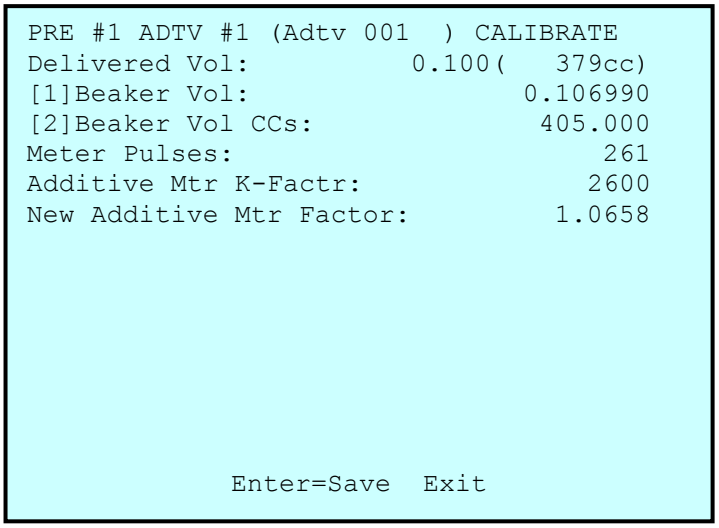


11. To enter the collected beaker volume in thousandths of a gallons, press **1**.
12. To enter the collected beaker volume in CCs, press **2** (as shown below).



13. At the ▌ prompt, key in the additive volume collected in the beaker, and press **Enter**.

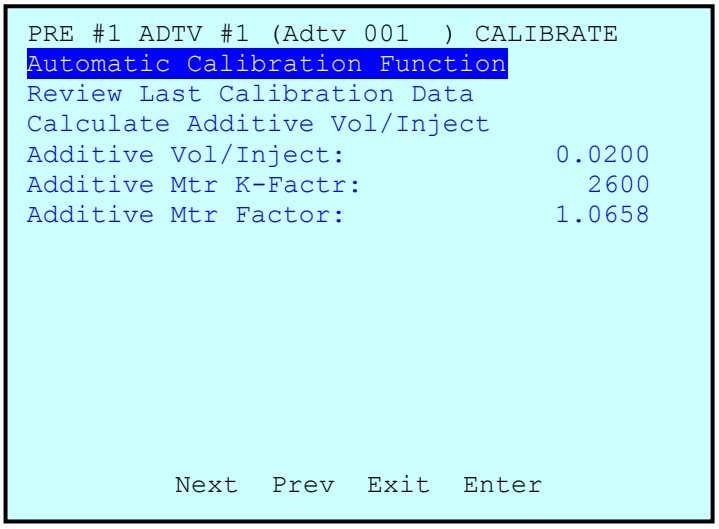
    (In the sample below, the value **405** was keyed in.)


PRE #1 ADTV #1 (Adtv 001) CALIBRATE
Delivered Vol: 0.100(379cc)
[1]Beaker Vol: 0.106990
[2]Beaker Vol CCs: 405.000
Meter Pulses: 261
Additive Mtr K-Factr: 2600
New Additive Mtr Factor: 1.0658
Enter=Save Exit

    The Beaker Vol value now reflects the beaker volume in thousandths of a gallon, and the new Additive Meter Factor displays on the last line..

14. Press **Enter** to save the new additive meter factor.

15. This returns you to the Additive Calibrate screen, which displays the new additive meter factor.

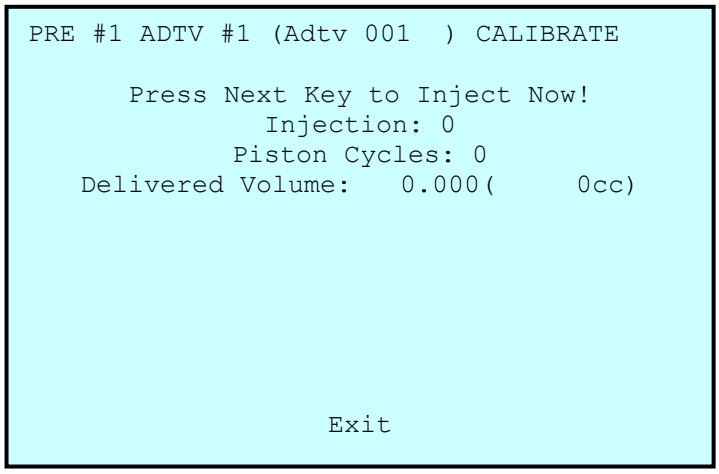

PRE #1 ADTV #1 (Adtv 001) CALIBRATE
Automatic Calibration Function
Review Last Calibration Data
Calculate Additive Vol/Inject
Additive Vol/Inject: 0.0200
Additive Mtr K-Factr: 2600
Additive Mtr Factor: 1.0658
Next Prev Exit Enter

    The new additive meter factor is now in effect.

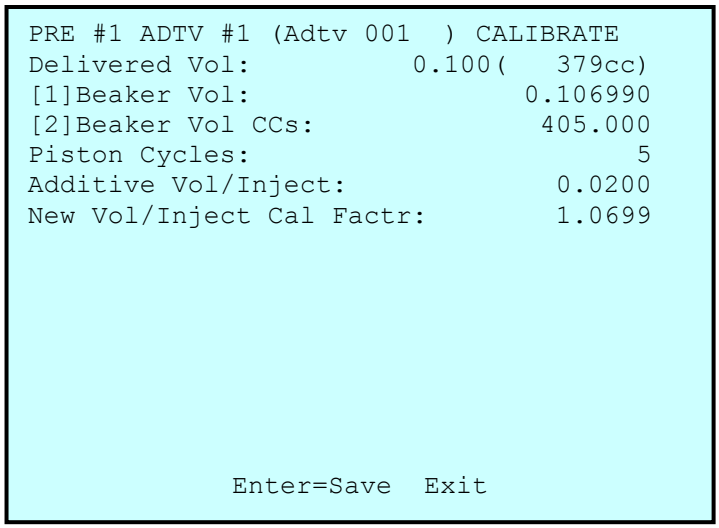
16. Press **EXIT** to exit to the Select Additive screen.

All additive volumes delivered during the calibration process will be added to the Unauthorized Totalizer of the additive under test.

6.7.3 PISTON TYPE ADDITIVE CALIBRATION



As noted previously, the calibration screens for Piston type injectors are slightly different than the screens used for additive flow meter injectors. The procedure, however, is identical.


PRE #1 ADTV #1 (Adtv 001) CALIBRATE
Delivered Vol: 0.100(379cc)
[1]Beaker Vol: 0.106990
[2]Beaker Vol CCs: 405.000
Piston Cycles: 5
Additive Vol/Inject: 0.0200
New Vol/Inject Cal Factr: 1.0699
Enter=Save Exit

The following is a screen sample for a Piston-type additive injector after calibration. Notice that the last three fields (Piston Cycles, Additive Vol/Inject, and Vol/Inject Cal Factr) are specific to the piston type of injector.

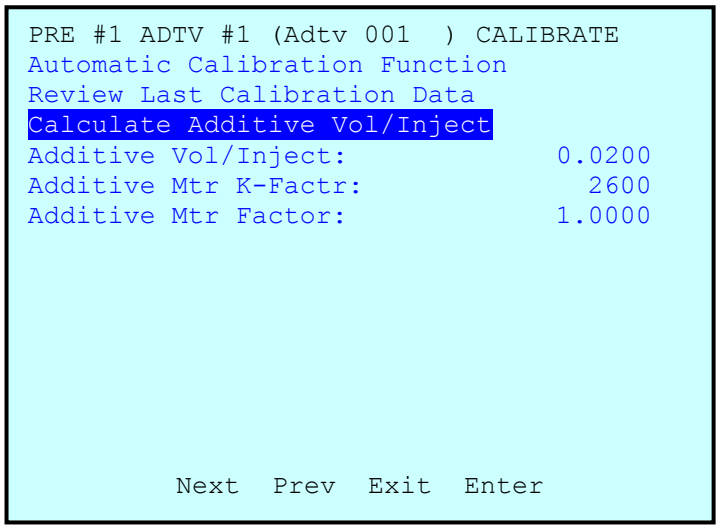
Parameter	Description
Beaker Vol	Volume collected in beaker, displayed in thousandths of a gallon.
Beaker Vol CCs	Volume collected in the beaker, displayed in CCs.
Piston Cycles	Number of piston strokes used in the calibration.
Additive Vol/Inject	The Additive Volume per Injection parameter is applicable to all additive methods. When using a piston system, with or without feedback, enter the volume of the calibrated cylinder as indicated by the manufacturer or calibration service. When the additive method involves a piston and an additive flow meter pulser, enter the cylinder size.
Vol/Inject Cal Factr	This factor will correct the calibrated cylinder volume to a gross observed volume, as actually measured during the additive calibration process. When an additive meter is involved, with or without a piston system, set the parameter to 1.0000.

6.8 CALCULATE ADDITIVE VOL/INJECT

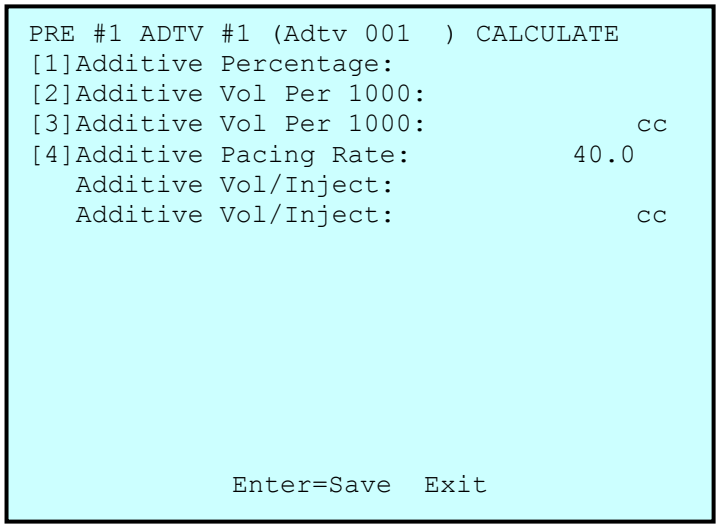
This feature can be accessed at the Additive Calibrate screen. The feature is a calculator that can assist the user in determining optimal vol/injection sizes based on known data such as the additive recipe percentage. Calculations are made to find a vol/injection size that will not overexert the injector or cause the injections to be timed too far apart. The resulting calculation for the vol/injection can be automatically entered for use by the system.

The volume per injection setting will determine how frequently injections are made. If the volume per injection setting is too small, the injector will have to work too hard to complete its requirement. Infrequent injections will be the result of a vol/injection setting that is too large; this may undermine the instantaneous additive/product ratio.

1. To use this feature, highlight “Calculate Additive Vol/Inject” and press **Enter**.


PRE #1 ADTV #1 (Adtv 001) CALIBRATE
Automatic Calibration Function
Review Last Calibration Data
Calculate Additive Vol/Inject
Additive Vol/Inject: 0.0200
Additive Mtr K-Factr: 2600
Additive Mtr Factor: 1.0000
Next Prev Exit Enter

2. The Following screen displays:



3. If the additive recipe percentage is known, Press the 1 button and key in the percentage. Calculated values will appear in the remaining fields.

In the example, a percentage of .05% was entered. The second field shows the volume of additive that will result in a load of 1000 volumetric units.

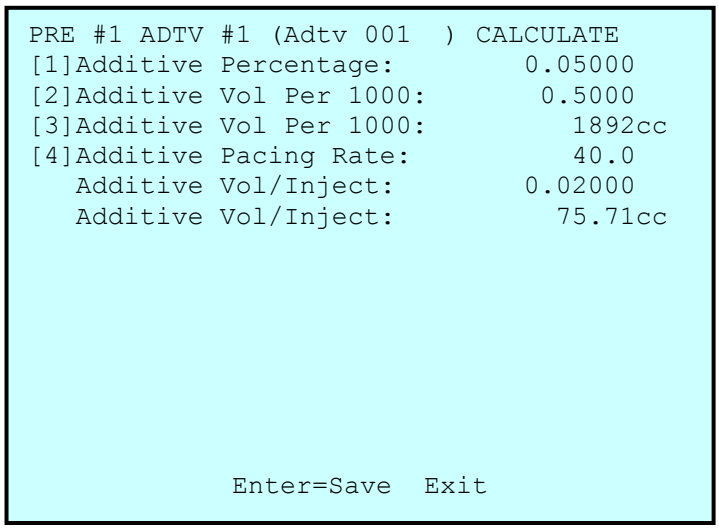

PRE #1 ADTV #1 (Adtv 001) CALCULATE
[1]Additive Percentage: 0.05000
[2]Additive Vol Per 1000: 0.5000
[3]Additive Vol Per 1000: 1892cc
[4]Additive Pacing Rate: 40.0
Additive Vol/Inject: 0.02000
Additive Vol/Inject: 75.71cc
Enter=Save Exit

Figure 6.8 Vol/Inj Calculated

The third field will show how many cubic centimeters of additive will be delivered in 1000 gallons. This field is only valid if the main product is delivered in gallons.

The fourth field will show the resulting pacing rate. The pacing rate is how often an injection will occur based on the recipe percentage entered. In the example, an injection will occur for every 40 units of volume that are delivered. If delivery is in gallons, the value of 40 often provides a nice, moderate rate of injection. When using units other than gallons, enter the equivalent of 40 gallons in the pacing rate field. A vol/injection calculation will result that should provide a moderate injection rate.

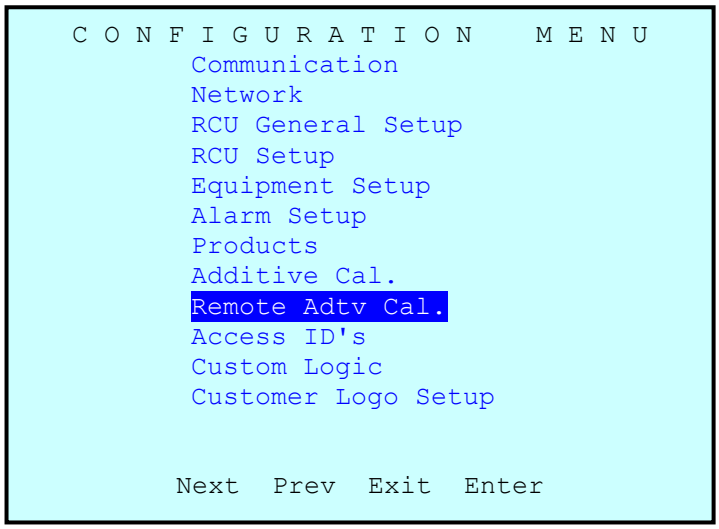
Following the pacing rate is the calculated volume per injection. This value should be used when configuring the additive. Press the Enter button to have this value implemented for the selected additive.

6.9 REMOTE ADDITIVE CALIBRATION

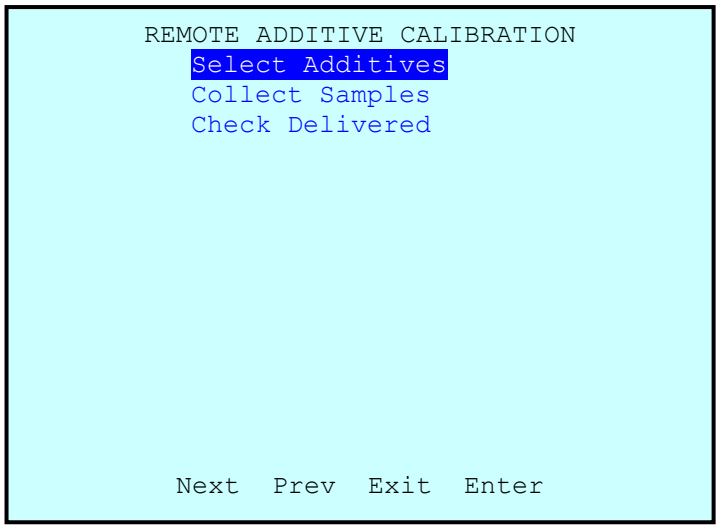
The Remote Additive Calibration feature enables the technician to select, in advance, all of the additives that will be tested in a calibration session. The injectors can be tested one right after the other without having to return to the MultiLoad II to enter data. Observed additive volumes are entered at one time after all samples have been measured and recorded.

The injections must be initiated by pushbuttons installed at the additive panels. To assign a pushbutton that is installed at the additive panel, go to the Additive menu and select Test Button FCM#. Select a port that will assign the pushbutton to an input port. This must be done for each additive that will be tested using Remote Additive Calibration.

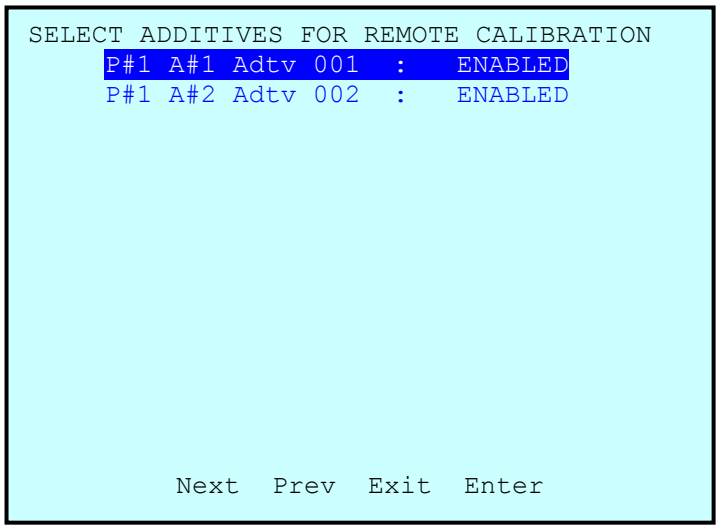
1. To begin the calibration procedure, enter Program mode and choose Configuration from the Main Menu.
2. Select Remote Adtv Cal and press **Enter**.



3. The Remote Additive Calibration menu displays:
4. Highlight Select Additives and press **Enter**.



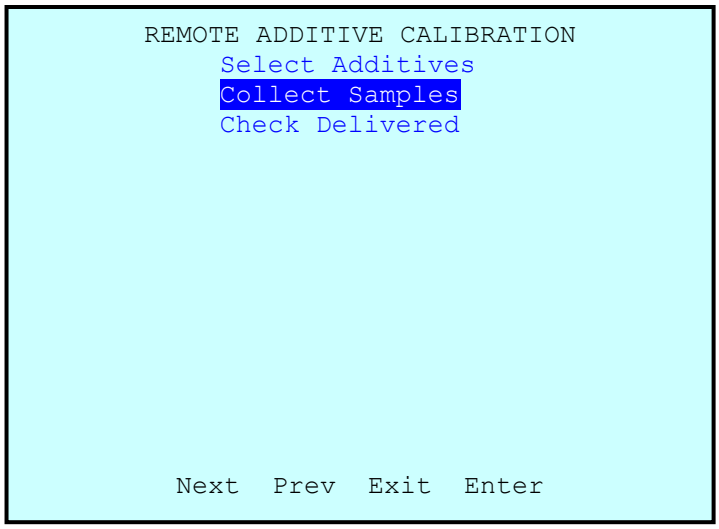
5. The Select Additives screen displays.



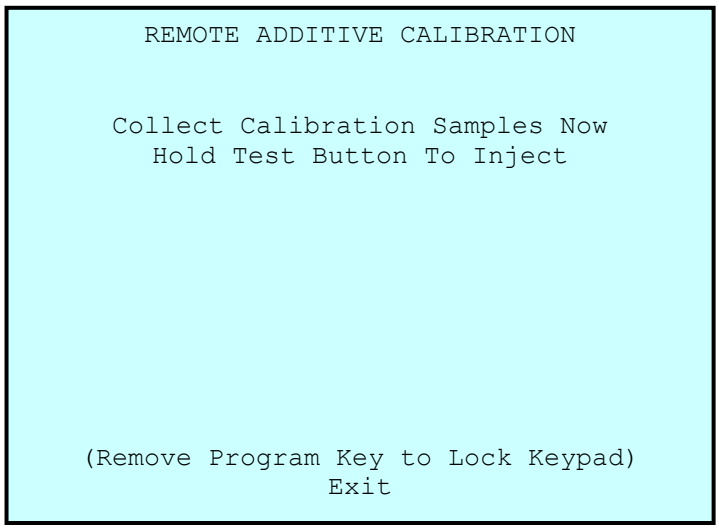
6. Select the additives that will be tested in the current session.

If multiple additives are assigned to the same test button, make sure that only one is enabled; otherwise the others may inject when the button is pressed.

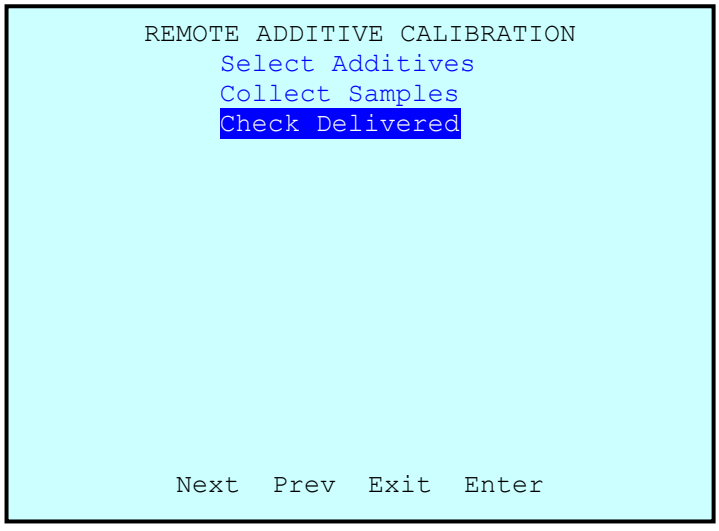
7. Press EXIT when all of the desired additives have been selected. This will return you to the Remote Additive Calibration menu.
8. Select 'Collect Samples'.



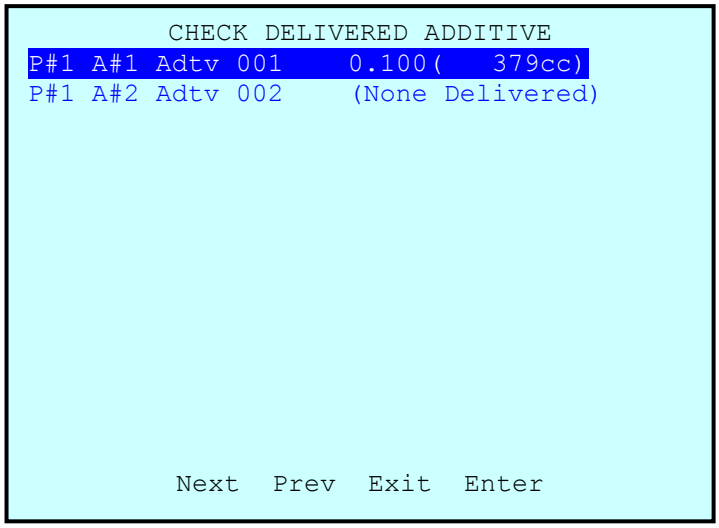
9. The technician is prompted to remove the program key in order to lock the MultiLoad II keypad; this is optional. Upon entering this screen, all of the additives that were enabled in the last step are now ready for calibration. The appropriate additive pump contacts will be activated and will remain that way until the screen is exited.



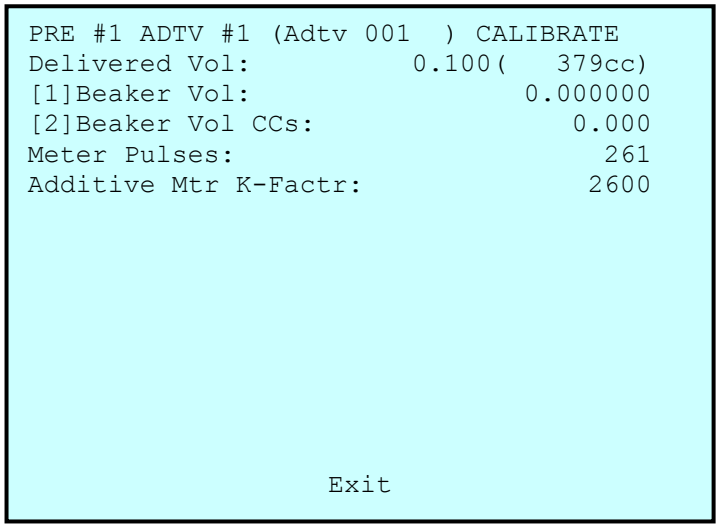
10. Choose one of the enabled additives to test. The order of testing does not matter. Place a receptacle at the first test point to collect the injected additive. Press the test pushbutton once for each injection desired. For example, if five injections are necessary to collect a measurable volume, press and hold the test pushbutton until the fifth injection starts.
11. When enough additive has been collected, record the measured results. Proceed to the next additive to be tested. Place a receptacle at the test point of the next additive to be tested and use the test pushbutton to this injector to collect a measurable sample. Record the results. Continue collecting samples and recording the results until all of the additive injectors have been tested. It is not required to test all of the additives that were enabled in the Select Additives step.
12. After all of the injectors have been tested, return to the MultiLoad II and unlock the MultiLoad II keypad with the Program Key if necessary. Press the Exit key to continue.



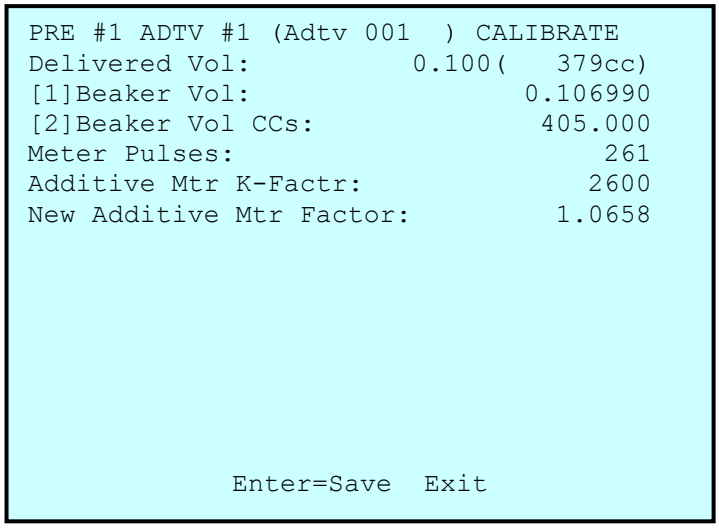
13. At the Remote Additive Calibration menu, select the Check Delivered option. The Check Delivered Additive screen displays:



14. The volume measured by each injector will be displayed. Select one of the additives that were tested. The detail screen for the selected additive displays.



15. Press 2 and key in the measured amount of additive in CCs collected for this additive, then press ENTER. (In the sample below, we'll use 405 CCs.)


PRE #1 ADTV #1 (Adtv 001) CALIBRATE
Delivered Vol: 0.100(379cc)
[1]Beaker Vol: 0.106990
[2]Beaker Vol CCs: 405.000
Meter Pulses: 261
Additive Mtr K-Factr: 2600
New Additive Mtr Factor: 1.0658
Enter=Save Exit

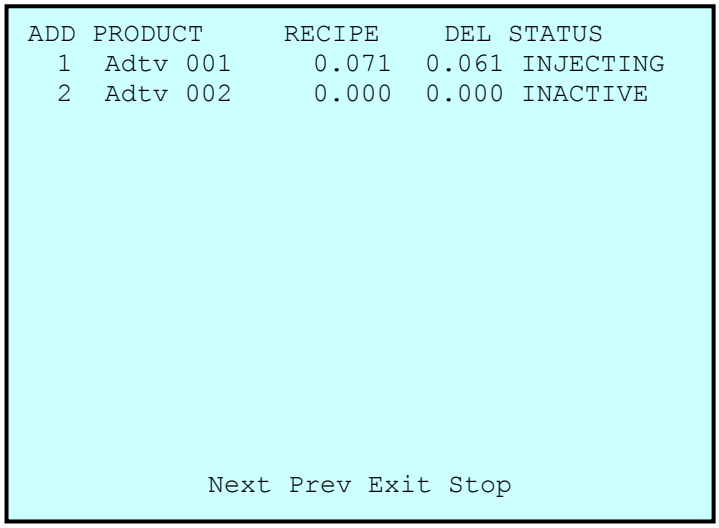
16. A new additive meter factor (or a new calibration factor for piston cylinder type) will be calculated automatically. The values on the screen change to reflect the actual volume you collected.
17. Press Enter to have the new factor take effect and to return you to the Check Delivered Additive screen, where you can select another additive for calibration.
18. When all additives have been calibrated, press the EXIT key until the program mode has been exited.

The new additive meter factor(s) or the new Cylinder calibration factor(s) are now in effect.

All additive volumes delivered during the calibration process will be added to the Unauthorized Totalizer of the additive under test.

6.10 ADDITIVE STATUS SCREEN

During operation, an additive status screen is available for each preset. The Additive Status screen, shown below, displays all additives that are associated with the preset. Additives that are assigned to a preset, but are not used for the current delivery, are labeled "INACTIVE". Additives that are used in the current delivery are labeled "READY." When an injection is commanded, the word "READY" will change to "INJECTING" during an injection cycle. The "RECIPE" column will maintain a running total of the quantity of additive that is required at any given moment in the batch. The "DEL" column shows the quantity of additive that has actually been delivered.



6.11 ADDITIVE FLUSH FEATURES

Usually, different additive brands are delivered through a single load arm. For these reasons, it is necessary to have the main product line flushed of additive by the time a load has ended. Flushing may be as simple as stopping injections at a certain point in the load and permitting the remaining product to clear the line of additive by the time delivery is complete. Or, flush pumps and valves may be used for applications that have demanding flush requirements, such as red dye. MultiLoad II has additional features to support hardware that has been designed for these applications.

6.11.1 BASIC FLUSH FEATURES

To flush the line, additive injections can be programmed to cease at a predetermined batch volume, permitting the volume remaining in the load to force the lingering additive out of the line. Often it is sufficient to stop additive delivery at the 1st trip stage of the delivery cycle, since the remaining load volume at the trip stages often exceeds the volume that exists between the additive injection point and the end of the load arm. Three parameters must be configured to set up a simple additive flush.

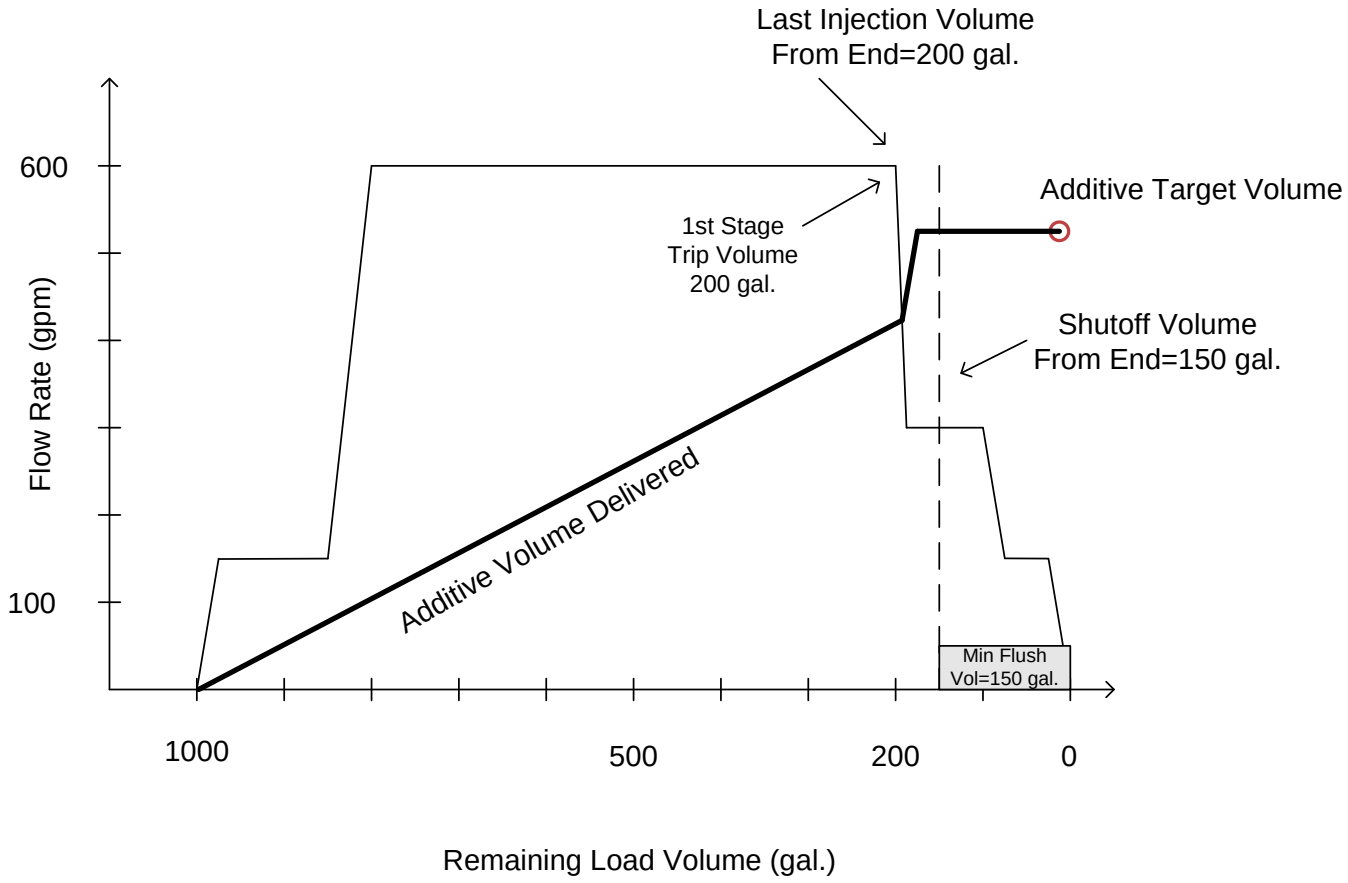


Figure 6.9 Basic Flush Cycle

Last Injection Volume From End-This parameter serves as a warning to the system, that a point is approaching where all additive for the load must be delivered. Determine the volume that exists between the injection point and the end of the load arm. If the 1st Trip Stage Volume is several times the volume that exists between the injection point and the end of the load arm, enter a value that is equal to the 1st Stage Trip Volume. When the load's remaining volume is equal to the Last Injection Volume From End, the system will begin its final injection to finish the additive demand of the load. This parameter should be set to a number that is higher than the volume specified in the Shutoff Volume From End parameter.

Shutoff Volume From End-When the volume remaining in the load reaches the value entered for Shutoff Volume From End, additive delivery will cease, regardless of the demand that is remaining. If the Shutoff Volume From End parameter is set to 150 gallons, additive delivery will stop when there is 150 gallons to be delivered. The remaining product volume will flush additive from the line.

Line Flush Min Vol-Set this parameter to ensure that the minimum required flush volume is delivered. If the load is aborted before enough product has flushed the line, an Additive Flush alarm will activate, warning that the flush may be insufficient.

Throughout most of the delivery cycle, the additive/product ratio will be within the specified recipe. When the final injection occurs, prior to reaching the volume specified by Shutoff Volume From End, the load will be slightly over additized. By the time the load is complete the additive/product ratio will be on target.

6.11.2 TECHNIQUES FOR FLUSHING DYE

Front Loading Dye

The flush cycle can be maximized by injecting the load's entire dye requirement at the very beginning of the delivery cycle. Flushing will occur for the majority of the load; the load will be over additized during most of the delivery. The Last Injection From End Volume can be set to a number that is equal to the maximum allowable preset quantity. This will cause the final injection to occur as soon as the batch is started. The Shutoff Volume From End should be set to a volume that is less than the Last Injection From End Volume. It may be necessary to experiment with this value. Find a volume range that provides enough time for the entire dye requirement to be delivered.

Consider the example in the diagram below. The Last Injection Volume From End is set at 1000 gallons. In a 1000 gallon batch, the dye will begin its final injection immediately. Since the additive Shutoff Volume is set to 700 gallons, the entire volume of dye required for a 1000 gallon batch must be delivered within the first 300 gallons of the load. This example may or may not be practical depending on the recipe amount and the hydraulic characteristics of the system. The remaining volume of the load can be used to flush the line. The Minimum Flush Volume can be extended to 700 gallons or less. If the load is aborted before a minimum amount of flush volume has passed, an Additive Flush alarm will occur.

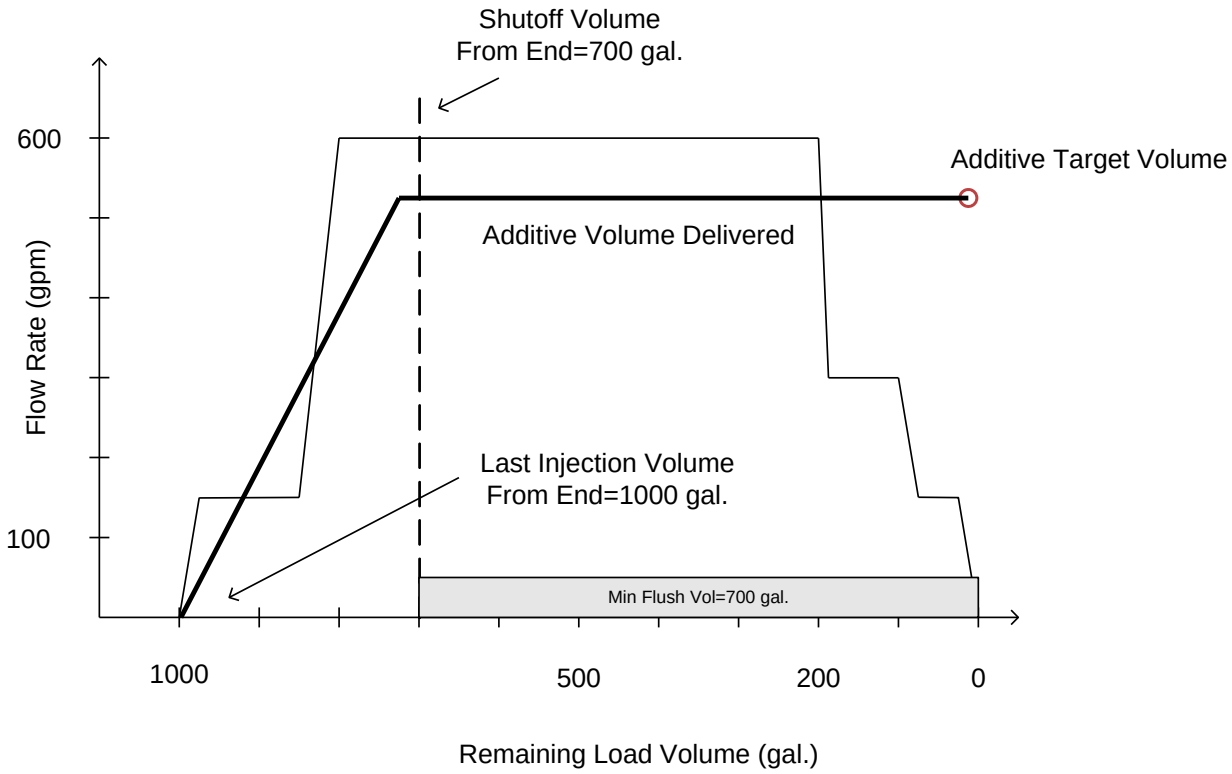


Figure 6.10 Front Loading Dye

6.11.3 BLOCK VALVES AND FLUSH PUMPS

Functionality exists in the MultiLoad II to support additive Block Valves and/or Flush Pumps. The Block Valves are mounted downstream of the additive meter and injector valve. The additive meter and injector valve are often integrated into a mono-block assembly. The Block Valve will reside downstream of the mono-block assembly as insurance against dye leaking past the assembly, while in an idle state.

The Block Valve will open when the MultiLoad II's Start button is pressed. The Block Valve will close as soon as the volume specified by the Shutoff Volume From End parameter is reached.

Flush Pumps have been devised to prevent dye from clinging to the output orifice of the Block Valve. After the final injection has been made and the Block Valve closes, the Flush Pump will activate for a pre-programmed period. The Flush Pump will circulate product across the Block Valve orifice, dislodging residual dye.

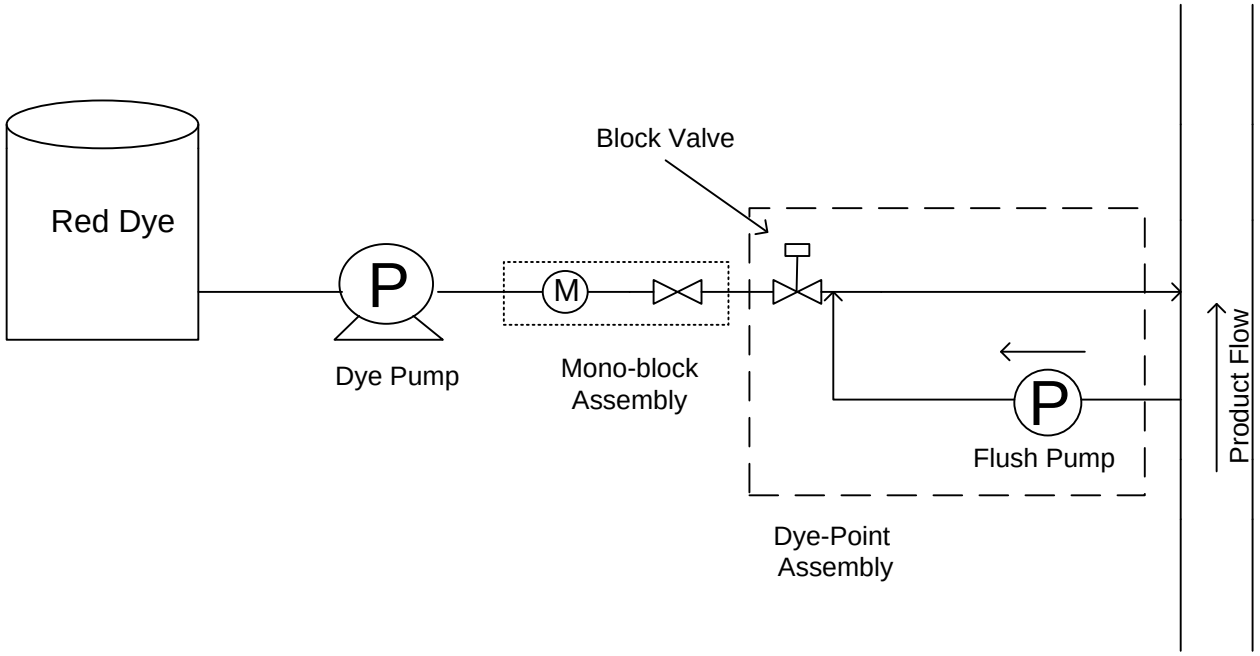


Figure 6.11 Mono-block Injector & Dye Point Assembly

To configure for a Block Valve, find the Open Blk Val FCM# parameter in the additive section. Assign an FCM and port to perform this function. For valves that require a separate closing signal and/or a valve status signal, ports can also be assigned for these functions.

To configure for a Flush Pump, find the Flush Pump Run FCM# parameter to assign a port for this function. Determine the amount of time required for an adequate flush and enter this value, in seconds, into the Flush Pump Run Time parameter.

Flushing Systems that use Multiple Block Valves on a Common Additive Meter

If the additive meter is in the flush path, it will generate pulses during the flush phase, when additive is no longer being delivered. In such a case, enable the Meter Flushed parameter. Meter pulses will then be ignored during the flush phase. Refer to the diagram.

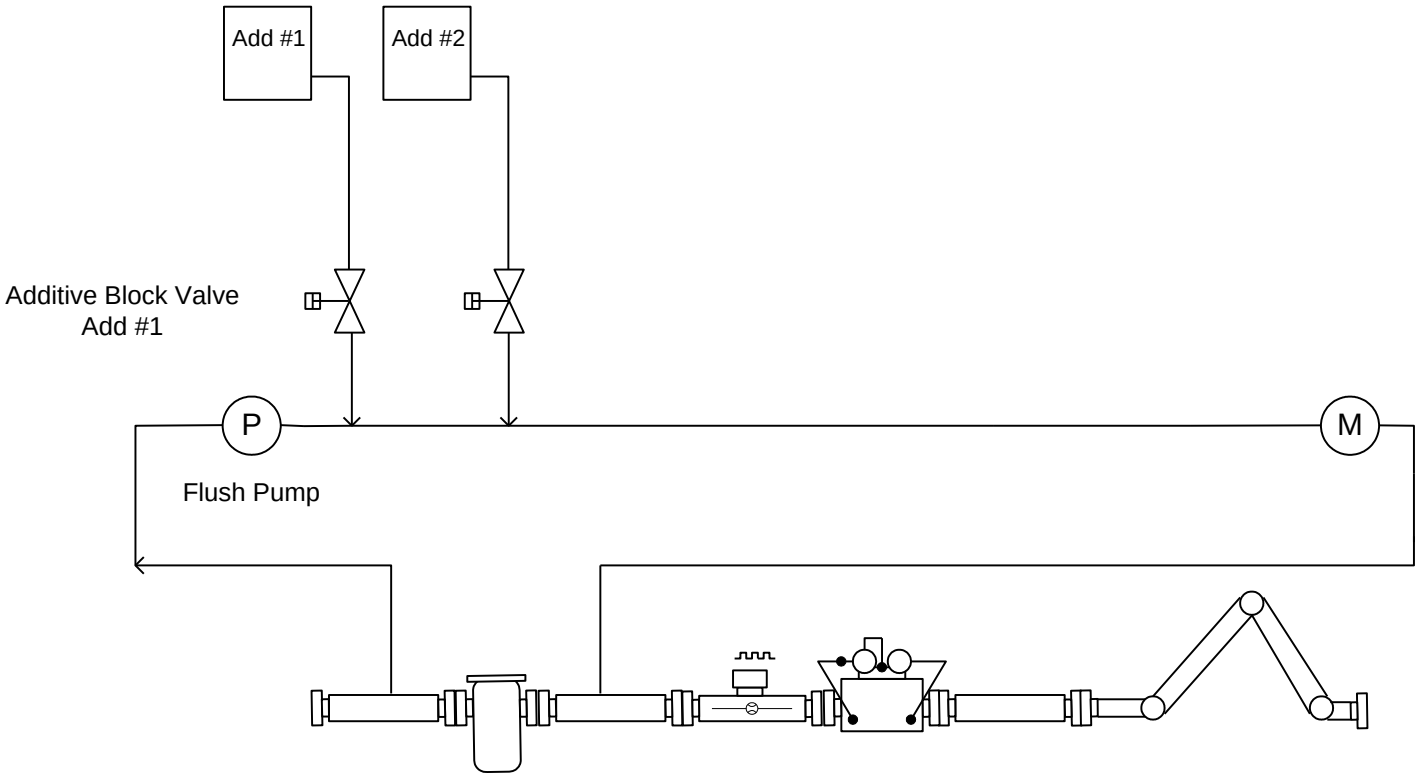


Figure 6.12 Additive Meter in Flush Path

If the Injector Valve is in the flush path, as in the diagram below, it will have to be held open during the flush phase. In such a case, enable the Solenoid Flushed parameter. The Injector Valve will then remain open during the flush phase.

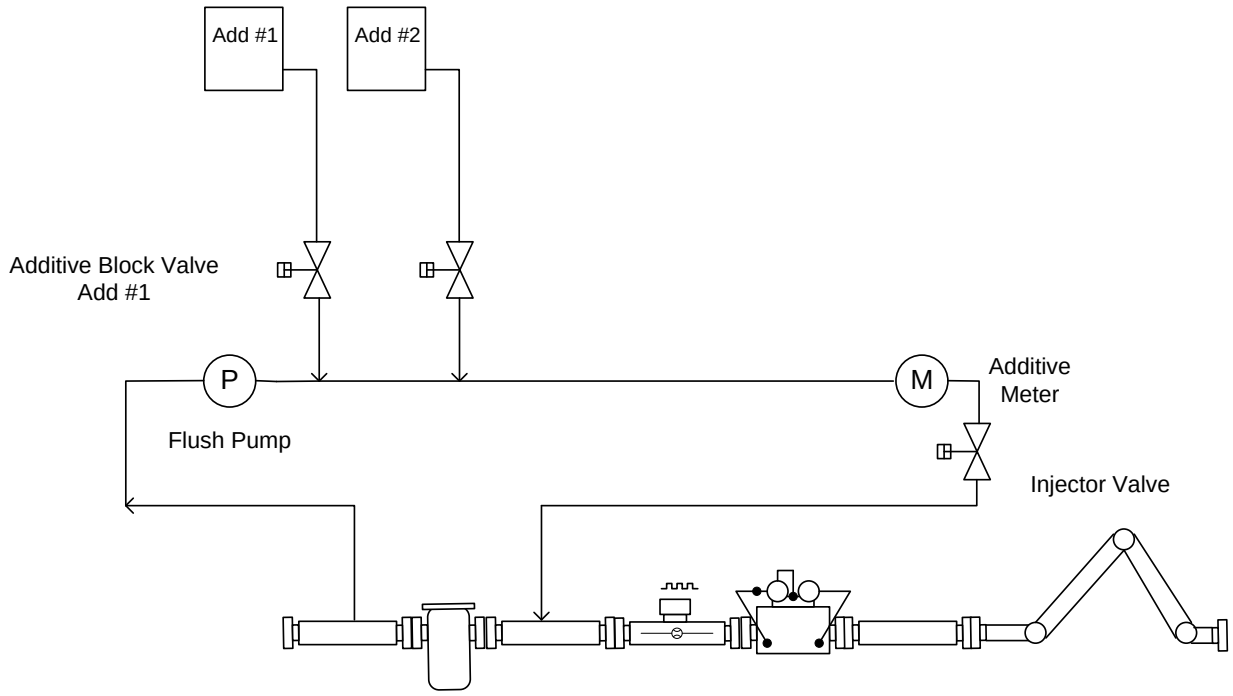


Figure 6.13 Additive Meter and Injector Valve in Flush Path

CHAPTER 7 SWING ARM SETUP AND OPERATION (EXCLUDING SMP)

7.1 OVERVIEW

Note: On the MultiLoad II SMP, swing arm operation is not possible.

A swing arm is mounted on an island and can be pulled to either of the two bays adjacent to the island.

On MultiLoad II, up to 12 swing arms can be assigned to a bay. A bay can have any combination of fixed load arms and swing load arms, provided the total number of load arms does not exceed 12 per bay.

The two bays served by a swing arm will each have an MultiLoad II RCU. Inputs and outputs associated with a swing arm's flow meter and control valve must reside on an external FCM(s) that are common to both MultiLoad II RCUs. This FCM will receive the flow meter(s) input and operates the control valve(s) for this swing arm and will communicate with the RCUs of both bays, but not simultaneously. A swing arm detector switch and a relay are used to make the appropriate communication connection between the swing arm FCM(s) and the selected bay MultiLoad II RCU. Each swing arm will employ two detector switches and one switching relay.
Please see Figure 7.1.

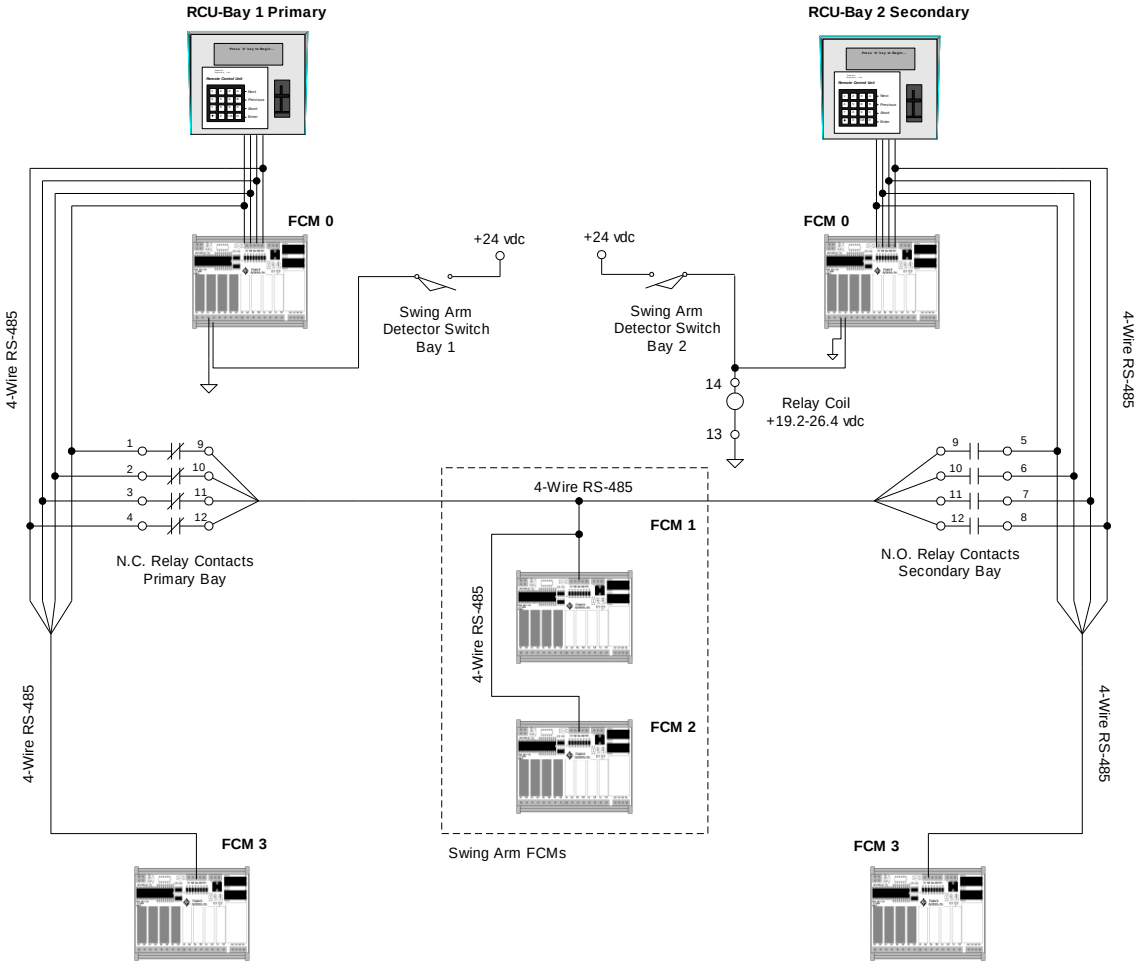


Figure 7.1 Swing Arm Configuration

7.2 SWING ARM OPERATION

When a swing arm is present and authorized in a bay, that bay's MultiLoad II RCU will show the swing arm as Idle. Load arms that are in an Idle state are arms that are ready to be used. Viewing the Load Screen of the other bay's MultiLoad II RCU will show a Swing Arm alarm as the status of the absent swing arm. The swing arm alarm cannot be cleared and it will not go away until the swing arm is moved back into the bay and its presence is detected by the MultiLoad II RCU. When a swing arm is absent from a bay, all other load arms in the bay can be used normally. A swing arm can be returned to a bay without negatively affecting a transaction that is in progress. For example, a driver may card in to a bay even though a swing arm is being used in the opposite bay. In addition, loading on other load arms in the bay can commence without the presence of a bay's swing arms. Any absent swing arms can be brought into the bay at any point during a transaction. When a swing arm is returned to a bay while a transaction is in progress, the Swing Arm alarm will automatically clear and its status will change to Idle. As soon as a swing arm's status is Idle, a product can be selected and loading can commence as with any load arm at the bay. Conversely, a swing arm can be moved out of a bay at any point during a transaction.

If a swing arm's batch is stopped prior to delivering the preset quantity and the swing arm is moved out of the bay, the batch on that arm is considered complete. If the arm is returned to the bay while the transaction is still in progress, there will not be an opportunity to finish the interrupted batch. When the arm returns to the bay, the status will indicate that the batch is complete. This batch must be cleared by pressing the CLR button before another batch can be started on the arm. If the transaction is terminated (card out) without returning the arm and manually clearing the batch, the batch will be archived, along with all other batches that occurred in the bay during the transaction.

7.3 RELAY AND SWITCH LOGIC

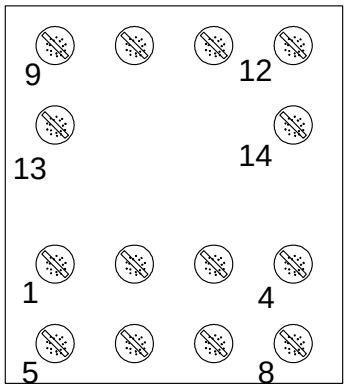
When a swing arm is moved out of a bay, the swing arm's FCM(s) are removed from that bay's MultiLoad II RCU/FCM communication circuit. Normally, when an FCM fails to communicate with a Remote Control Unit, an FCM communication failure alarm occurs. But, since the FCM(s) is associated with a swing arm, it is expected that these FCMs will drop out of the communication circuit from time to time. If a true FCM communication failure occurs due to open circuits or due to FCM board failure, the failure will be detected by the RCU that has the active swing arm detector switch. The bay with the active swing arm detector switch is expecting to see all FCMs associated with the swing arm.

When a swing arm is in a neutral position, both swing arm detector switches will be open and the relay coil will be de-energized. When the relay coil is de-energized, the normally closed (N.C.) contacts link the swing arm FCMs to the primary MultiLoad II RCU. Since the swing arm is in the neutral position and no swing arm detector switches are closed, the primary and secondary MultiLoad II RCUs will show swing arm alarms.

Moving the swing arm into the primary bay closes that bay's swing arm detector switch, indicating to the primary MultiLoad II RCU that the swing arm is present. The relay coil remains de-energized and the N.C. contacts continue to link the swing arm FCMs to the primary MultiLoad II RCU. With the closing of the swing arm detector switch, the swing arm alarm in the primary MultiLoad II RCU clears.

Moving the swing arm into the secondary bay closes the secondary bay's swing arm detector switch. The secondary MultiLoad II RCU then expects to communicate with the swing arm FCMs. Closing the secondary bay swing arm detector switch energizes the relay coil. The normally open (NO) relay contacts in the secondary bay close, connecting the swing arm FCMs to the communication circuit of the secondary MultiLoad II RCU. The NC contacts of the primary bay are opened as the relay coil is energized, severing the communication link between the swing arm FCMs and the primary MultiLoad II RCU.

	Relay Pin	Primary Bay FCMs	Swing Arm FCMs	Secondary Bay FCMs
	1	J3-4 (TDB)	X	X
	2	J3-3 (TDA)	X	X
	3	J3-2 (RDB)	X	X
	4	J3-1 (RDA)	X	X
	5	X	X	J3-4 (TDB)
	6	X	X	J3-3 (TDA)
	7	X	X	J3-2 (RDB)
	8	X	X	J3-1 (RDA)
	9	X	J3-4 (TDB)	X
	10	X	J3-3 (TDA)	X
	11	X	J3-2 (RDB)	X
	12	X	J3-1 (RDA)	X
Relay Coil	13	X	X	common
Relay Coil	14	X	X	+24 VDC or 115 VAC Via Swing Arm Switch



Relay Socket
Swing Arm FCMs
Communication Switching

Relay Socket-Square D- Part # 8501NR45

Relay-Square D-Part # 8501RSD34V53

Figure 7.2 Swing Arm FCM Relay Socket

7.4 SWING ARM CONFIGURATION

Perform the following steps when configuring two bays to share one or more swing arms.

Designate one of the bay MultiLoad II RCUs to be the swing arm secondary RCU. It does not matter which RCU is chosen as the secondary. To make a RCU the secondary, go to the designated RCU and enter the program mode. Select the Configuration menu and then select RCU Setup. In the RCU Setup menu, find the parameter labeled Swing Arm Secondary. Enable this parameter and then exit the program mode. It will not be necessary to set this parameter again, if additional swing arms are added to a bay in the future. Go to the primary RCU and ensure that the Swing Arm Secondary parameter is disabled.

Choose one of the bay MultiLoad II RCUs to configure; it does not matter which bay is configured first. For purposes of this discussion, the primary MultiLoad II RCU will be configured first. Enter the program mode of the primary RCU. Select the Configuration menu and then select Equipment Setup. Enter the Preset menu. Select a preset that will be configured as a swing arm. In the Preset menu find the parameter labeled Swing Arm FCM#. Press Enter. Press Next to enable the parameter. Enter a number that represents the Flow Control Module (FCM) that will contain the input port for the bay's swing arm detector switch.

The FCM chosen must not be an FCM dedicated to the swing arm's functions; it must be an FCM that is connected to a single MultiLoad II RCU.

The first FCM on the communication circuit (FCM 0) must not be a swing arm FCM.

After entering an FCM#, enter a number that represents the input port that will receive the detector switch signal. Select any available port.

Configure other Preset menu parameters as necessary. Any Preset level I/O assignments that must be made will have to be assigned to one of the swing arm's FCMs, which will be on the common MultiLoad II RCU communication circuit. Otherwise, the same I/O function will have to be configured on both MultiLoad II RCUs. Make a note of the swing arm FCM port assignments, since they will be used in the secondary MultiLoad II RCU. Exit the Preset menu and return to the Equipment Setup menu.

Select and enter the Meters menu. Select the preset that has been assigned to the swing arm that is being configured. Select Meter #1. The first parameter is Flow Control Module #. Enter a number that represents the FCM that will be used to operate the swing arms control valve and monitor the swing arm's flow meter input. Ports two and three will be reserved for the upstream and downstream solenoid outputs respectively. Port four will be reserved for flow meter pulse input A. Port five is available for flow meter input pulse B or for any other function associated with the swing arm. Any unused ports on this FCM must be reserved for this swing arm's use only, since the FCM will not be available to either bay all of the time.

Configure other Meters menu parameters as necessary. Any Meter level I/O assignments that must be made will have to be assigned to one of the swing arm's FCMs, which will be on the common MultiLoad II RCU communication circuit. Otherwise, the same I/O function will have to be configured on both MultiLoad II RCUs. Make a note of the swing arm FCM port assignments for entry in the other secondary MultiLoad II RCU. Exit the Meters menu and return to the Equipment Setup menu.

Configure Component level parameters for the swing arm. In cases where the swing arm component pumps are common to other load arms in the bay, Pump Run and Pump Status assignments should be made to FCMs that are dedicated to a single MultiLoad II RCU. That means that the pump-related I/O assignments would have to be configured on both MultiLoad II RCUs. If a component pump is only needed for the swing arm, however, it may be more efficient to assign the pump-related I/O to the swing arm FCM ports. Block Valve Open and Block Valve Status assignments must be made to swing arm FCM ports, which will be on the common MultiLoad II RCU communication circuit.

Configure Additive level parameters for the swing arm. The output port that signals the injection and the input port that receives the injector feedback must be assigned to a swing arm FCM. Configure the Flow Control Module # parameter; enter a number that represents a swing arm FCM. Configure the FCM Port # parameter for an available port on the swing arm FCM. Consult the General Additive Setup section in Chapter 6 in the User Guide for instructions on choosing an additive port. Additive Test Buttons used for calibration must be assigned to a Swing Arm FCM as well.

In cases where the swing arm additive pumps are common to other load arms in the bay, Pump Run and Pump Status assignments should be made to FCMs that are dedicated to a single MultiLoad II RCU. That means that the assignment will have to be configured on both RCUs. If an additive pump is only used for the swing arm, however, it may be more efficient to assign the pump related I/O to the swing arm FCM.

If configuration of the primary RCU is complete, configure the load arms of the secondary RCU. When configuring the swing arms of the secondary unit, use the same FCM and port assignments as were used for the corresponding swing arm in the primary bay.

	A swing arm in the secondary bay does not have to use the same Preset number assignment as the primary bay. For example, if a swing arm has been assigned to preset #1 in the primary bay, that same swing arm can be assigned to Preset #2 in the secondary bay. When configuring the swing arm for the secondary bay, use the same FCM and port assignments as were used in the primary bay.

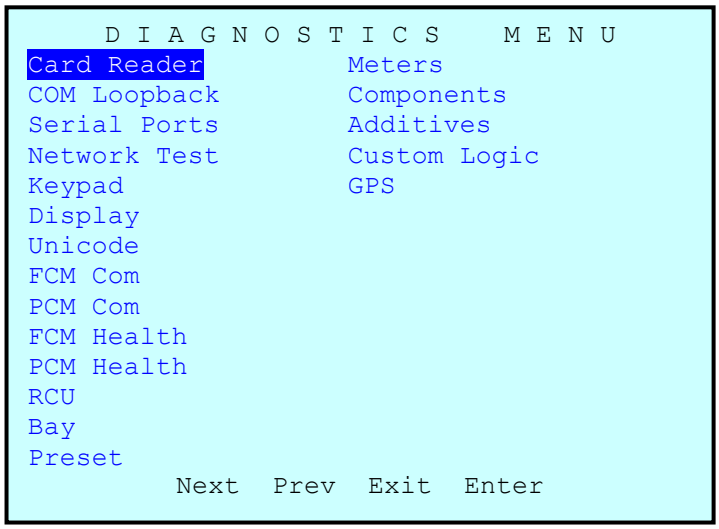
	When performing meter proving, the resulting meter factors must be entered in both bay MultiLoad II RCU's.

	When setting up swing-arm bays, do NOT enable any swing-arm flags in TMS. MultiLoad swing-arm bays are considered independent bays by TMS.

CHAPTER 8 DIAGNOSTICS

8.1 OVERVIEW

The MultiLoad II provides built-in diagnostic tools that enable your technician(s) or electrician(s) to isolate wiring or hardware problems by performing various tests. The main diagnostic functions available from the Diagnostics Menu and described in this chapter are:



Card Reader (Excluding SMP)	Tests the prox card reader.
COM Loopback	Tests communication ports to and from the host system (TMS)
Network Test	Tests network connection to and from the host system (TMS)
Keypad	Tests the individual keys on the keypad
Display	Tests display operation
Unicode	Tests display fonts
FCM Com	Reports communication status with the I/O board and FCMs
PCM Com	Reports communication status with PCMs
FCM Health	Reports the number of timeouts and lost communication events with the I/O board and FCMs.
PCM Health	Reports the number of timeouts and lost communication events with PCMs.
RCU	View/modify RCU level I/O including the Program and W&M key switch status.
Bay	View/modify Bay level I/O.
Preset	View/modify Preset level I/O.
Meters	View/modify Meter level I/O.
Components	View/modify Component level I/O..
Additives	View/modify Additive level I/O.
Custom Logic	Tests the custom logic execution.
GPS	Displays the current detailed status of the GPS.

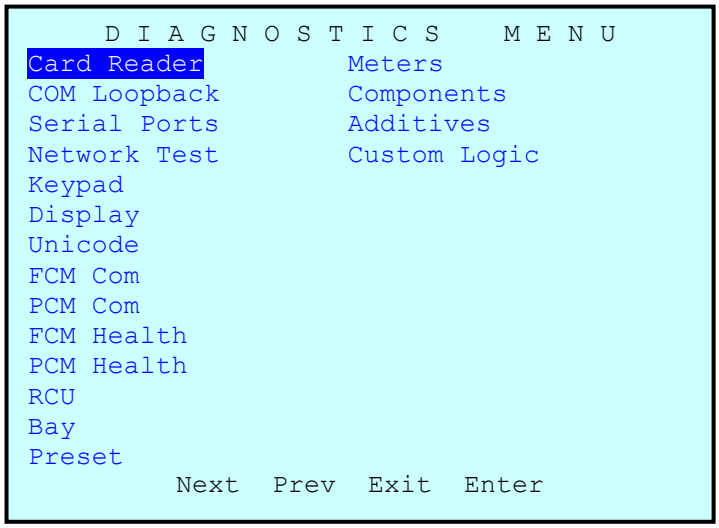
These functions are discussed in the order they appear on the Diagnostics menu.

8.2 CARD READER (EXCLUDING SMP)

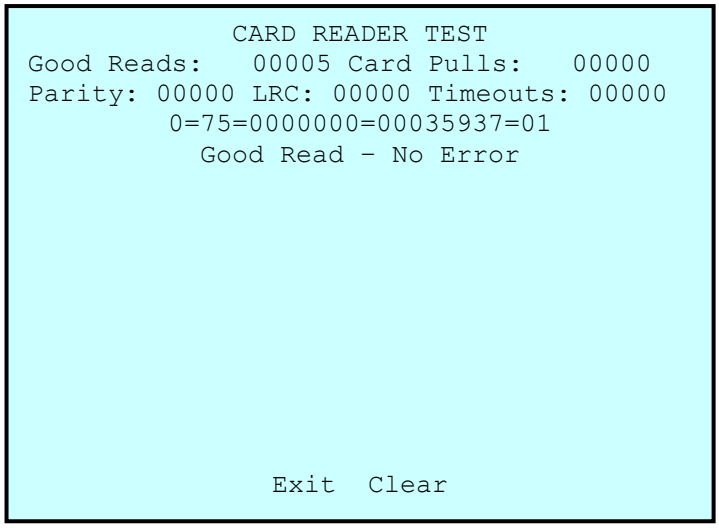
Note: If the MultiLoad II is a SMP or does not have a card reader installed, this test is not applicable.

Use the Card Reader function to verify the operation of proximity card reader and a driver card.

From the DIAGNOSTICS MENU, choose **Card Reader.**



The Card Reader Test screen displays. After placing a card in the reader card holder the screen will update after each read of the card.

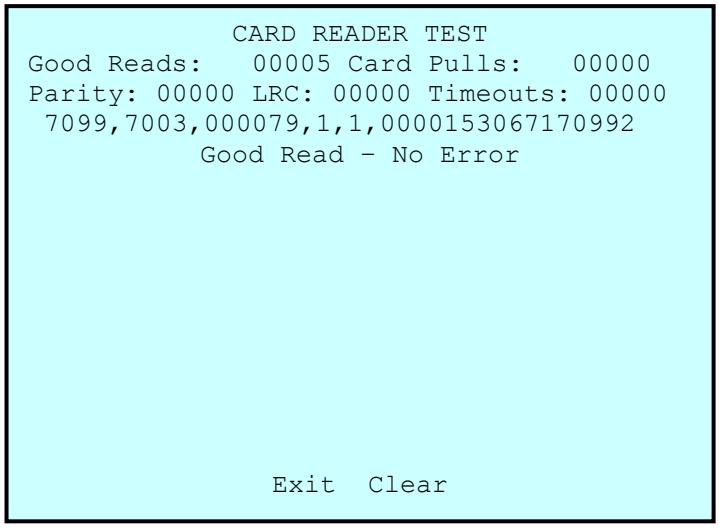


The diagnostic data reported is:

- Good Reads – Number of times a successful read of the card is performed. This value should increment approximately once every second while a card is inserted.
- Card Pulls – Number of times a card has been removed from the card reader.
- Parity, LRC, Timeouts – Number of times a certain read error has occurred. These values should remain zero.
- For HID 26-bit Prox Cards, 0=yy=0000000=xxxxxxxx=01 – Card number that was read from the card.
  Where:
  yy is the facility number (00-99)
  xxxxxxxx is the card number (00000000-00065535).

- For HID 26-bit Corporate 1000 Prox Cards, 0=yyyy=00000=xxxxxxxx=01 – Card number that was read from the card.
  Where:
  yyyy is the facility number (00-4095)
  xxxxxxxx is the card number (00000000-01048575).
- For HID 37-bit H10320 formatted Prox cards, 0=yy=0000000=xxxxxxxx=01 – Card number that was read from the card.
  Where:
  yy is the facility number (Always 00).
  xxxxxxxx is the card number (00000000-99999999).

When reading a TWIC card, the Card Reader Test screen displays.



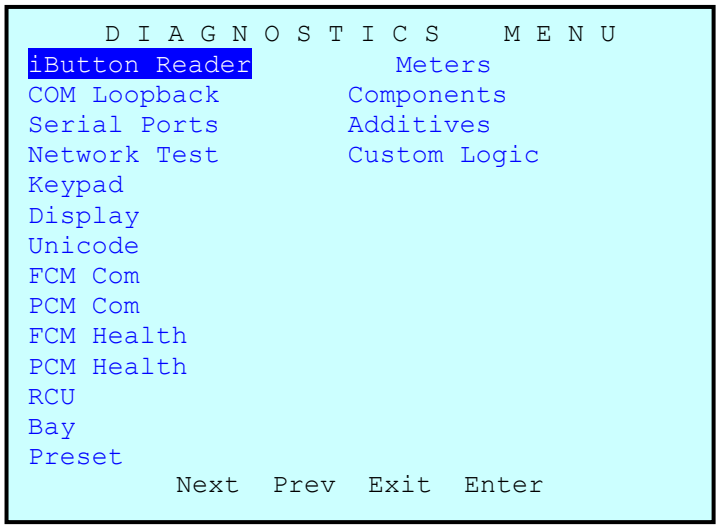
- The diagnostic data reported is:
  1111,2222,333333,4,5,6666666666788889 – TWIC Card FASC-N that was read from the card.
  Where,
  1111 = Agency Code
  2222 = System Code
  333333 = Credential Number
  4 = Credential Series
  5 = Individual Credential Issue
  6666666666 = Person Identifier (Used as Card Number in Access ID Database)
  7 = Organizational Category
  8888 = Organizational Identifier
  9 = Person/Organization Association

8.3 iBUTTON READER (EXCLUDING SMP)

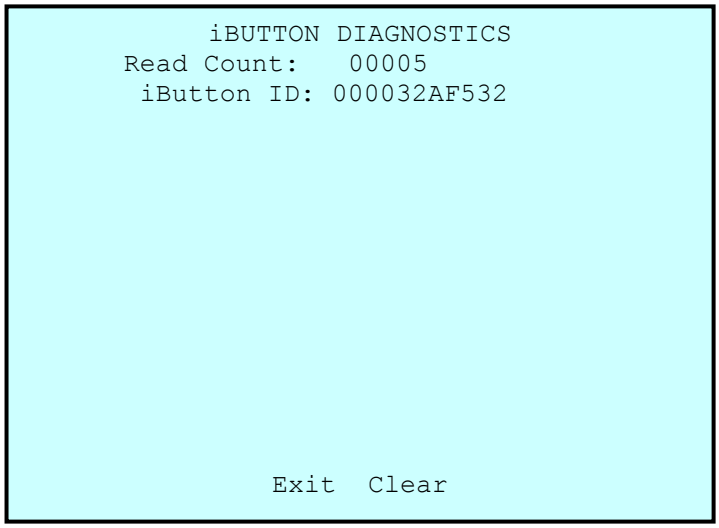
Note: If the MultiLoad II is a SMP or does not have a iButton installed, this test is not applicable.

Use the iBUTTON function to verify the operation of ibutton and a driver card.

From the DIAGNOSTICS MENU, choose **iBUTTON Reader.**



The iButton Reader Test screen displays. After placing a ibutton at the reader the screen will update after each read of the ibutton.

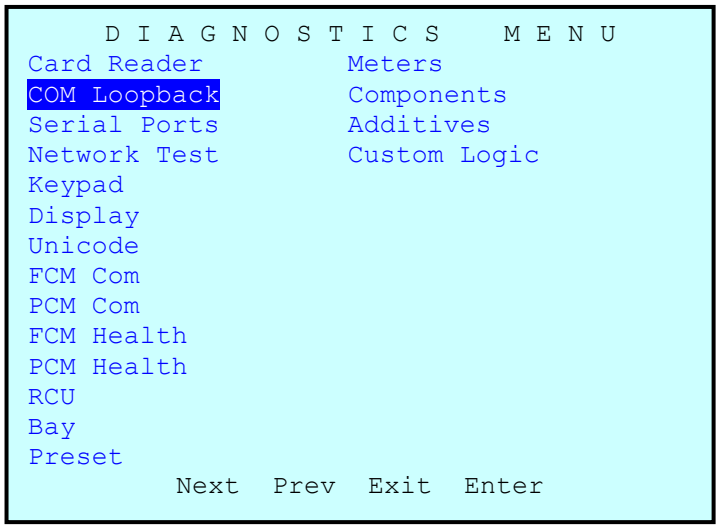


8.4 LOOPBACK TEST

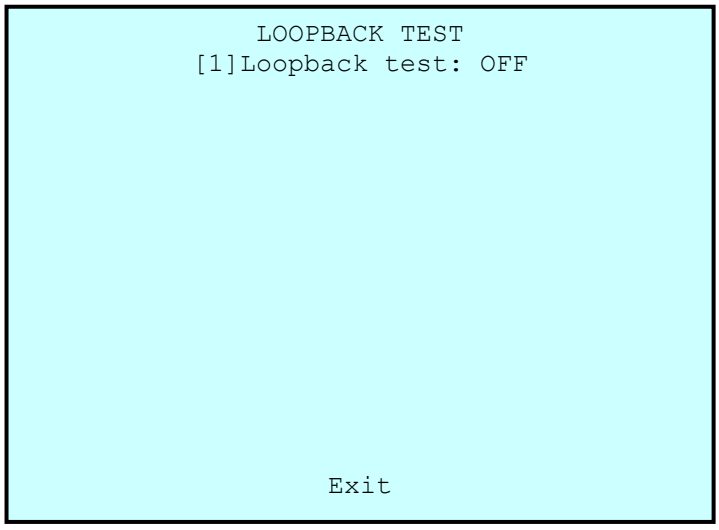
The Loopback Test is used for two purposes:

- To test the transmit and receive capabilities of Host COM Port on MultiLoad II.
- To troubleshoot serial communication problems between MultiLoad II and the host system (TMS).

From the DIAGNOSTIC MENU, choose **COM Loopback**.



The Loopback Test screen displays:



Using Loopback to test communication between MultiLoad II and TAS computer:

1. Press the **1** key to toggle the Loopback Test to ON.
2. When Loopback is turned ON, press any key at the MultiLoad II keypad and the character pressed will be transmitted out the Serial Port assigned to the Host.
3. If transmissions are not received at the TMS computer or the Optical Isolator, determine if the MultiLoad II is capable of transmitting data.

> *TMS users can run the TMSLCOMM utility in Loopback mode to determine if characters are being received by the computer.*
>
> *Alternatively, Loopback can be set to continuously transmit a "testing" message. Press the 1 key to toggle the Loopback Test to AUTO.*

Using Loopback to test transmission capability of MultiLoad II:

1. At MultiLoad II Serial Port assigned to the Host, disconnect the communication cable and short the following terminals.

    a. *RS232 – RX to TX (or)*
    b. *RS485 - RDA to TDA, RDB to TDB*

2. When Loopback is turned ON, press any key at the MultiLoad II keypad and the character pressed should appear on the MultiLoad II display indicating a successful loop back. Failure of the character to appear on the display may indicate a bad Com Port or invalid communication setup.

> When testing is complete, press the **1** key to toggle Loopback Test to OFF.

Auto Mode:

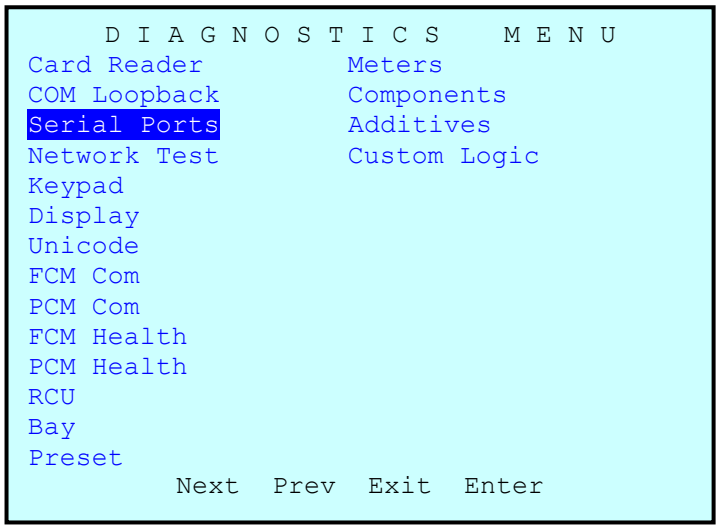
If you press **1** again, you will be in Auto mode. When Auto mode is turned On:

- The character string "Testing…" is sent out from the Serial Port assigned to the Host once every second.
- Any character received on the serial port assigned to the Host will be displayed on the MultiLoad II screen.

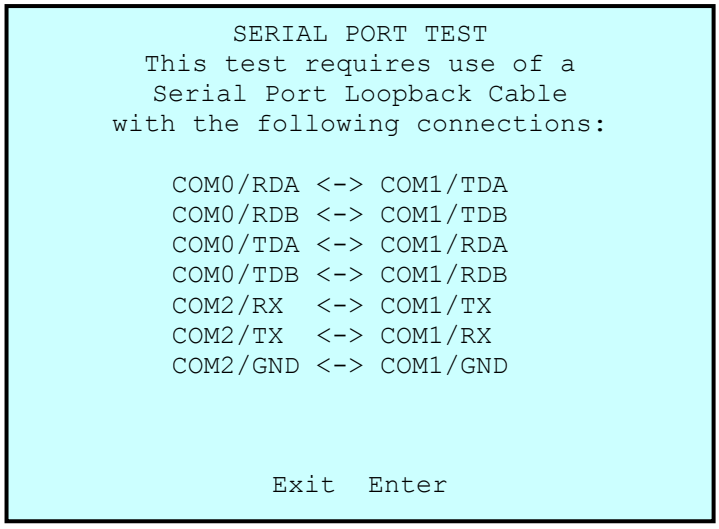
8.5 SERIAL PORT TEST

The Serial Port Test is used to verify the serial port hardware of the MultiLoad II. This test provides a method for service personnel to determine the serial port hardware health before sending equipment back to Toptech for repair.

From the DIAGNOSTIC MENU, choose **Serial Ports**.

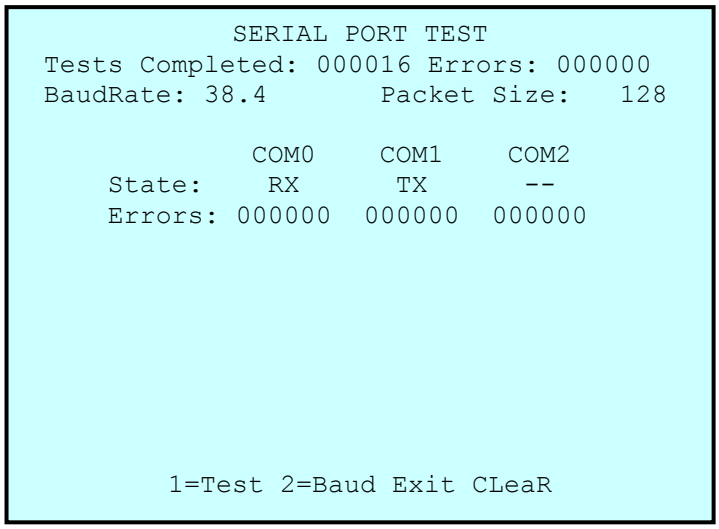


The Serial Port Test introduction screen displays:



Note: To conduct this test a special loop back cable must be constructed with the connections listed above. This test will fail without this loop back cable in place.

Once the cable is installed, press Enter. The Serial Port Test screen displays and the test begins.

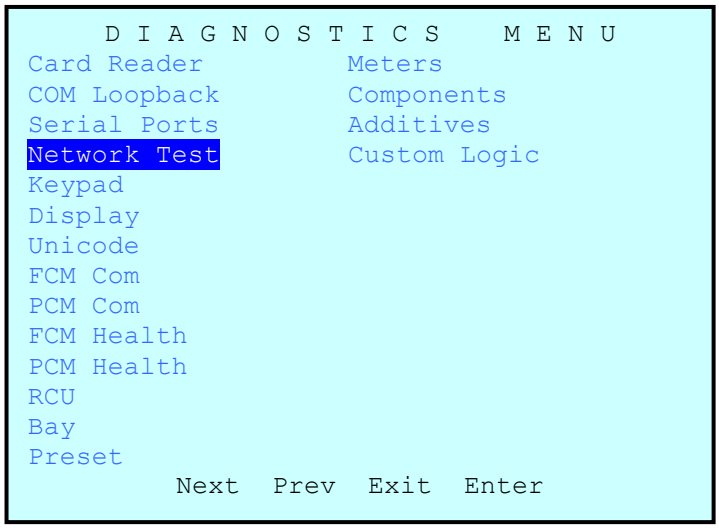

SERIAL PORT TEST
Tests Completed: 000016 Errors: 000000
BaudRate: 38.4 Packet Size: 128
COM0 COM1 COM2
State: RX TX --
Errors: 000000 000000 000000
1=Test 2=Baud Exit CLeaR

Press Exit to end the test.

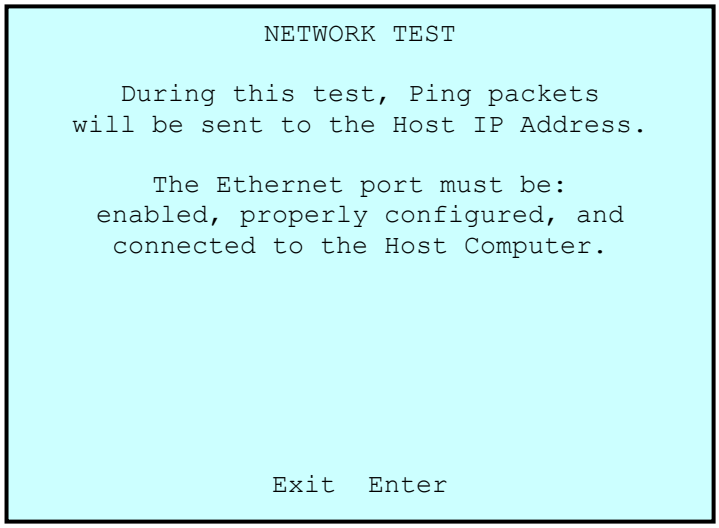
8.6 NETWORK TEST

The Network Test is used to verify or troubleshoot the network connection between the MultiLoad II and Host (TMS) system:

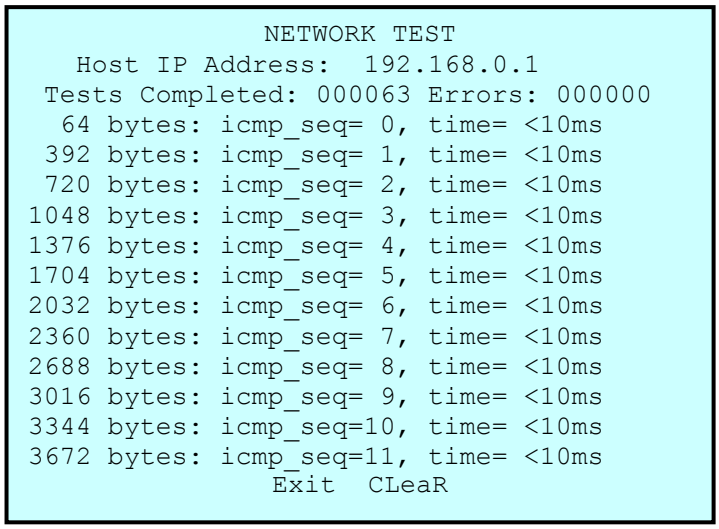
From the DIAGNOSTIC MENU, choose **Network**.



The Network Test introduction screen displays:


NETWORK TEST
During this test, Ping packets
will be sent to the Host IP Address.
The Ethernet port must be:
enabled, properly configured, and
connected to the Host Computer.
Exit Enter

Press Enter. The Network Test screen displays and the test begins.

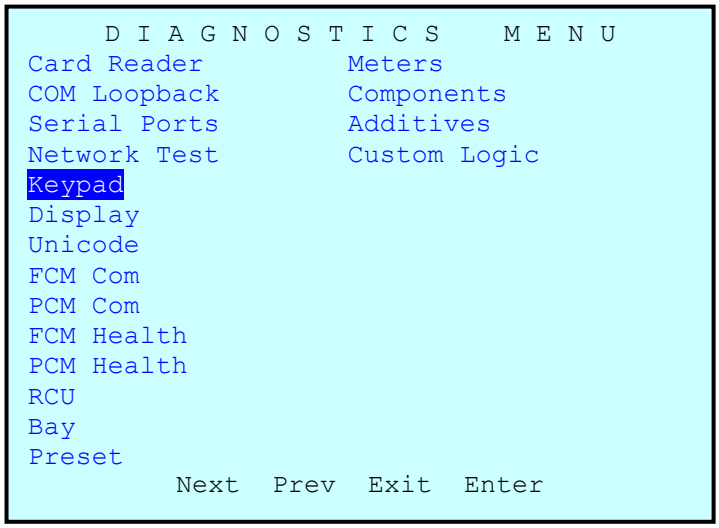

NETWORK TEST
Host IP Address: 192.168.0.1
Tests Completed: 000063 Errors: 000000
64 bytes: icmp_seq= 0, time= <10ms
392 bytes: icmp_seq= 1, time= <10ms
720 bytes: icmp_seq= 2, time= <10ms
1048 bytes: icmp_seq= 3, time= <10ms
1376 bytes: icmp_seq= 4, time= <10ms
1704 bytes: icmp_seq= 5, time= <10ms
2032 bytes: icmp_seq= 6, time= <10ms
2360 bytes: icmp_seq= 7, time= <10ms
2688 bytes: icmp_seq= 8, time= <10ms
3016 bytes: icmp_seq= 9, time= <10ms
3344 bytes: icmp_seq=10, time= <10ms
3672 bytes: icmp_seq=11, time= <10ms
Exit CLeaR

Press Exit to end the test.

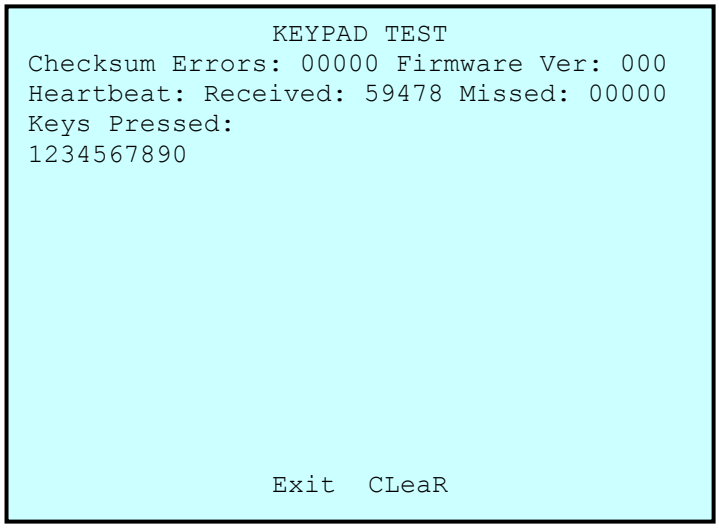
8.7 KEYPAD TEST

The Keypad test enables you to prove that the keypad is working by testing the individual keys.

1. From the DIAGNOSTICS MENU, choose **Keypad**.



2. The Keypad Test screen displays:
3. Type: **1234567890**

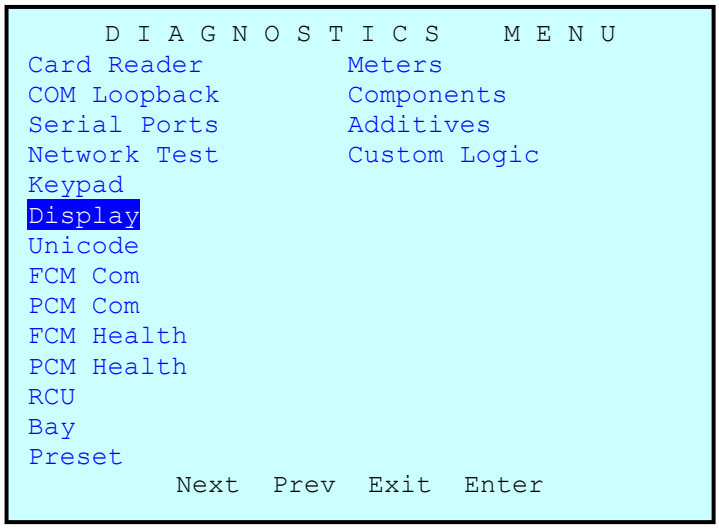


4. Press any key that is suspected of failure.
5. If a key is operating properly, its character will be displayed on the diagnostic screen each time the key is pressed. If the character for a particular key does not appear on the screen when pressed, or appears multiple times, it may be necessary to replace the keypad.
6. Any counts in the Checksum Errors or Missed could also indicate a keypad failure.

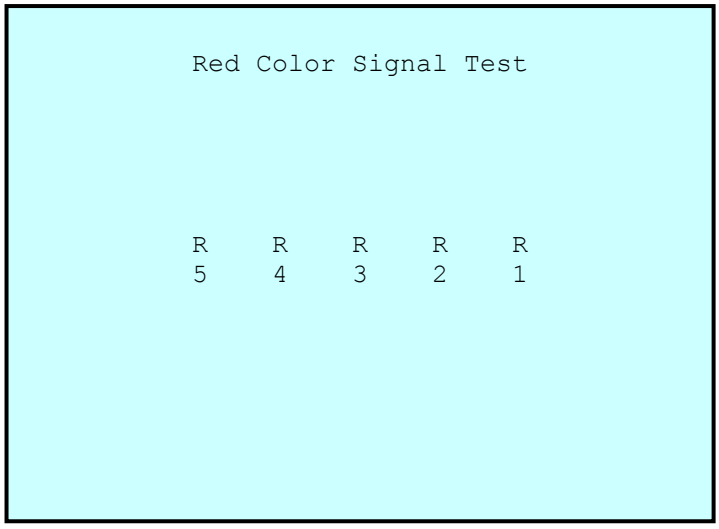
8.8 DISPLAY TEST

Use this function to test the MultiLoad II display.

1. From the Diagnostics Menu, select **Display**.



2. The Display Test screen displays. As part of the Display test, the screen cycles through a Color Bar Test, Red Color Signal Test, Green Color Signal Test, Blue Color Signal Test and several Font Tests. Any missing colors or corrupt fonts could indicate a display or display cable failure.

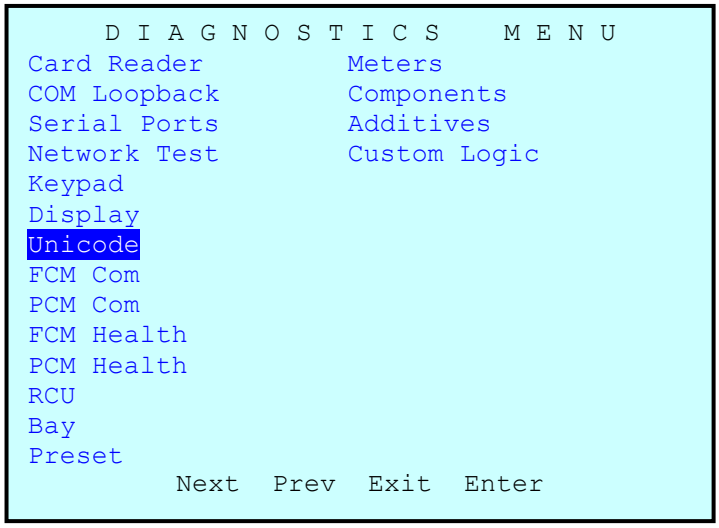


3. Press Next or Prev to manually step through the Display Tests. Press **Exit** to end the test.

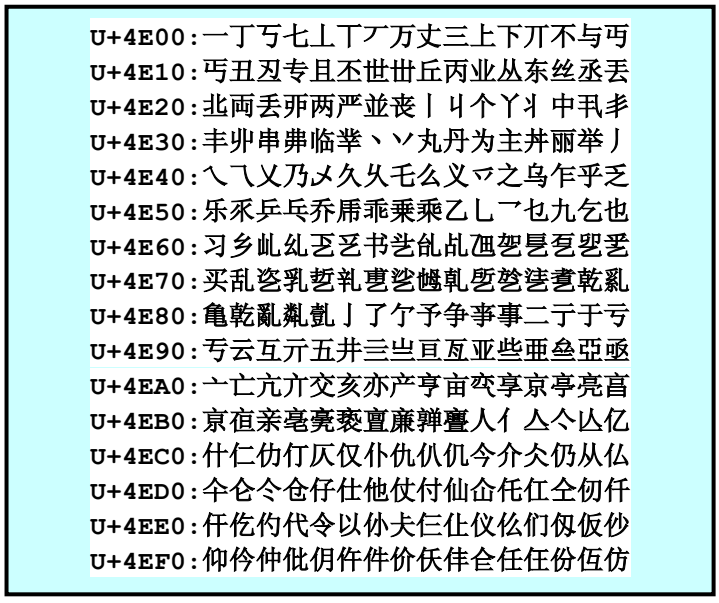
8.9 UNICODE TEST

Use this function to view the supported Unicode fonts.

4. From the Diagnostics Menu, select **Unicode**.



5. The Unicode Test screen displays and positions itself on the Hiragana Unicode Character set.

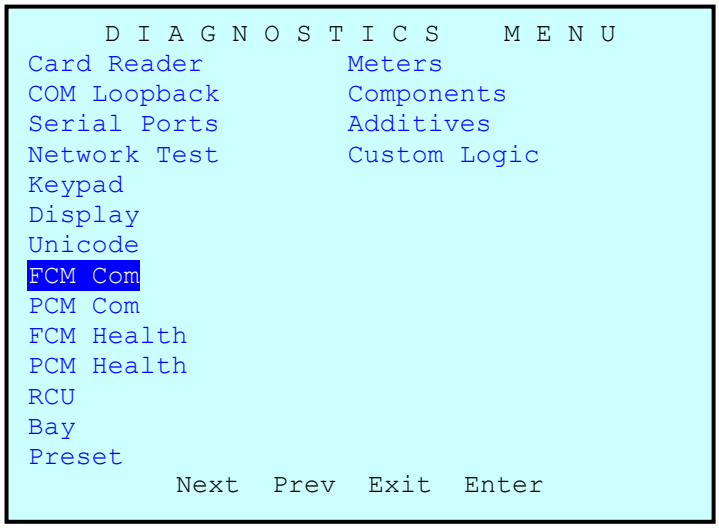


6. Press Next or Prev to step forward and backward through the Unicode code points. Press **Exit** to end the test.

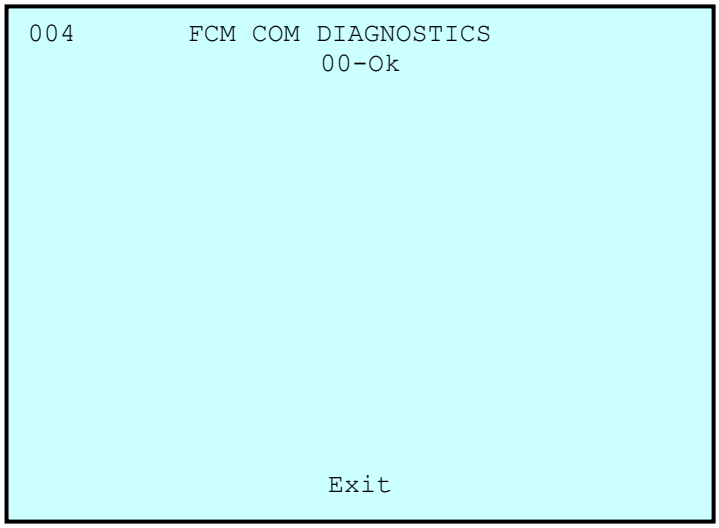
8.10 FCM COMMUNICATIONS

Use this function to determine if the internal I/O board or external FCMs are communicating with the MultiLoad II.

1. From the Diagnostics Menu, select FCM Com.



2. The FCM COM Diagnostics screen displays:

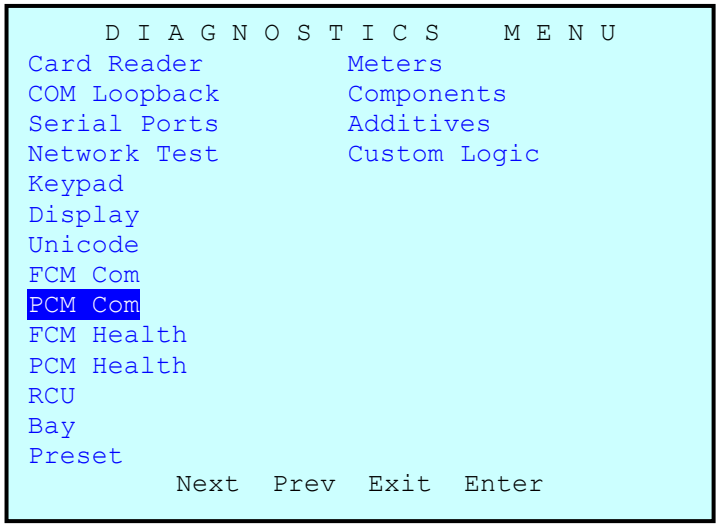


3. An I/O board or FCM that is not communicating will display ERR.
4. When communications are restored, the ERR message will change to OK.

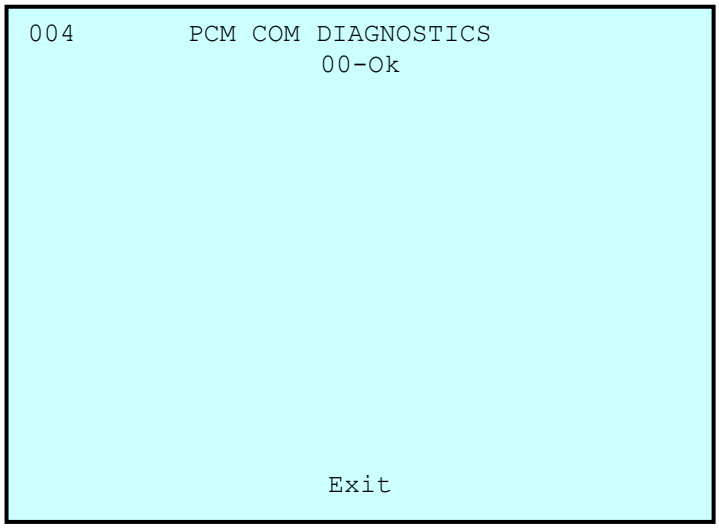
8.11 PCM COMMUNICATIONS

Use this function to determine if a PCM is communicating with the MultiLoad II.

1. From the Diagnostics Menu, select PCM Com.



2. The PCM COM Diagnostics screen displays:

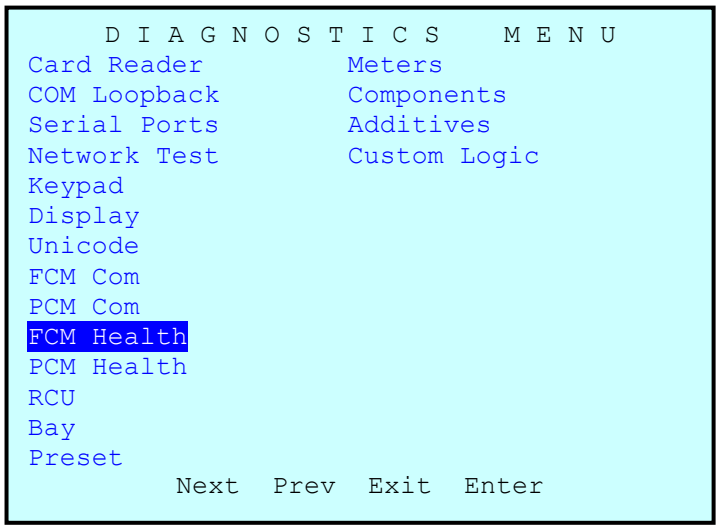


3. A PCM that is not communicating will display ERR.
4. When communications are restored, the ERR message will change to OK.

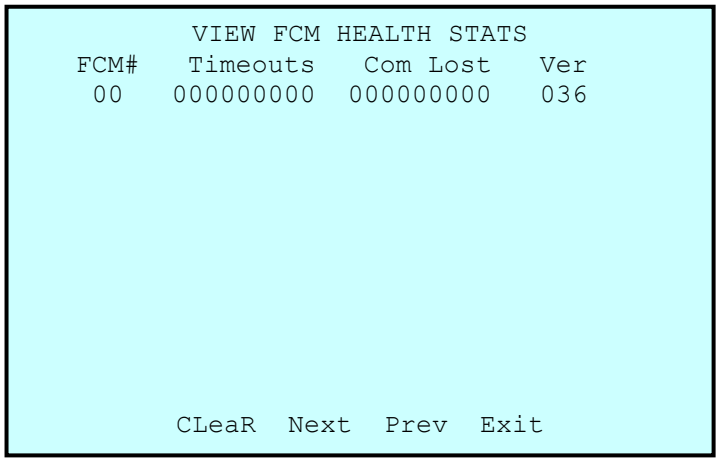
8.12 FCM HEALTH STATUS

The FCM Health Status feature can be used to detect intermittent communication failures between the MultiLoad II and the internal I/O board or external FCMs.

1. From the Diagnostics Menu, select **FCM Health**.



2. The View FCM Health Status screen displays:



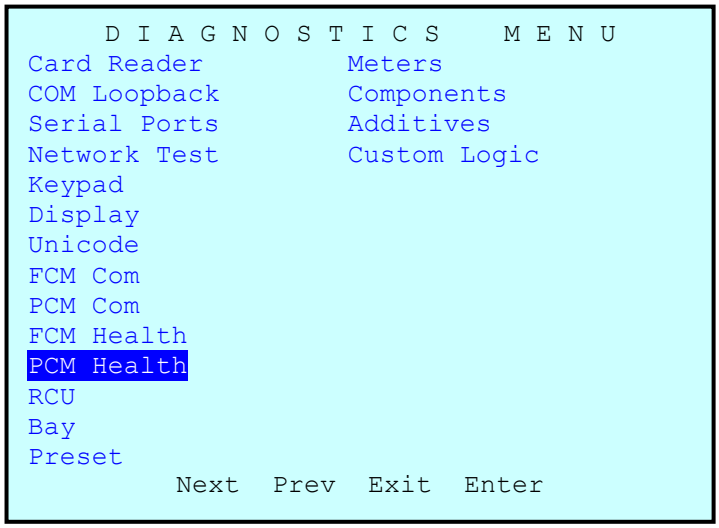
3. After making a repair, press the **CLR** key to reset the totalizers. Then return to this screen to determine the effectiveness of the repair.

FCM#	Flow Control Module number. I/O board-1Meter is 00 and 2-Meter is 00 and 01.
Timeouts	A timeout occurs when MultiLoad II does not receive a response from the internal I/O board or external FCM after a poll is sent. The MultiLoad II interprets three consecutive timeouts to mean that communications with the internal I/O board or external FCM has been lost. The Timeouts totalizer increments each time a timeout occurs.
Com Lost	The Com Lost totalizer is incremented whenever three consecutive timeouts have occurred.
Ver	Displays the firmware revision number or Err if communications are currently lost with the internal I/O board or external FCM.

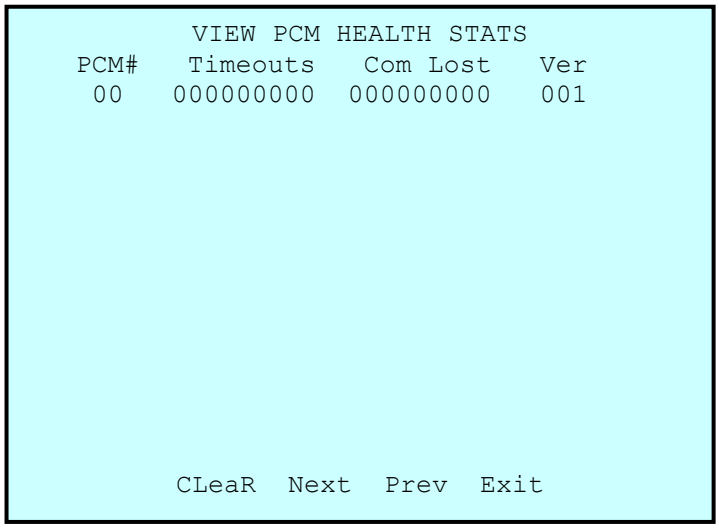
8.13 PCM HEALTH STATUS

The PCM Health Status feature can be used to detect intermittent communication failures between the MultiLoad II and a PCM.

1. From the Diagnostics Menu, select **PCM Health**.



2. The View PCM Health Status screen displays:



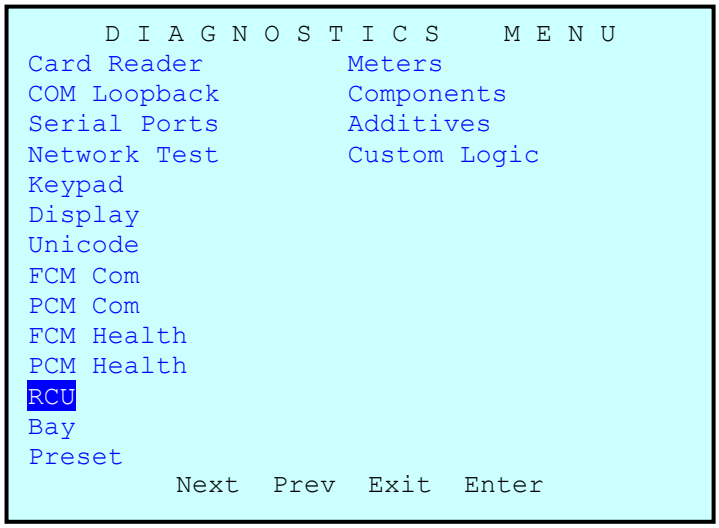
4. After making a repair, press the **CLR** key to reset the totalizers. Then return to this screen to determine the effectiveness of the repair.

PCM#	Flow Control Module number.
Timeouts	A timeout occurs when MultiLoad II does not receive a response from a PCM after a poll is sent. The MultiLoad II interprets three consecutive timeouts to mean that communications with the PCM has been lost. The Timeouts totalizer increments each time a timeout occurs.
Com Lost	The Com Lost totalizer is incremented whenever three consecutive timeouts have occurred.
Ver	Displays the firmware revision number or Err if communications are currently lost with the PCM.

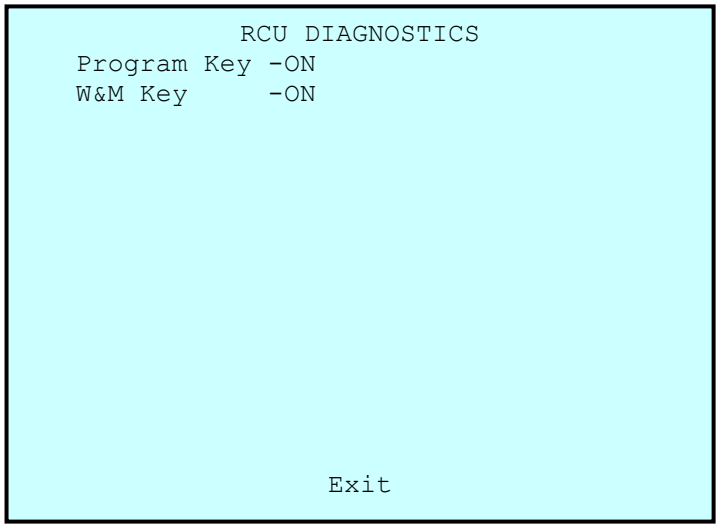
8.14 RCU DIAGNOSTICS

The RCU Diagnostics screen displays the state of the MultiLoad II Program switch, the Weights and Measures switches.

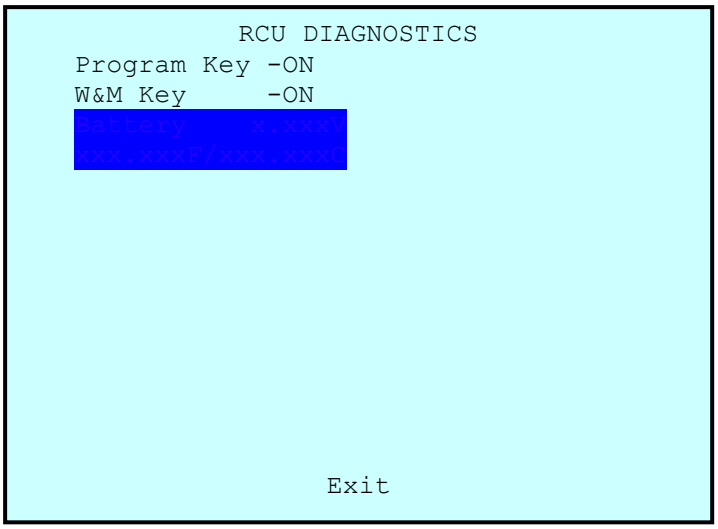
1. From the Diagnostics Menu, select **RCU**.



2. The RCU Diagnostics screen displays:



The newest Hardware will also show the battery voltage and the internal temperature of the Multiload2.

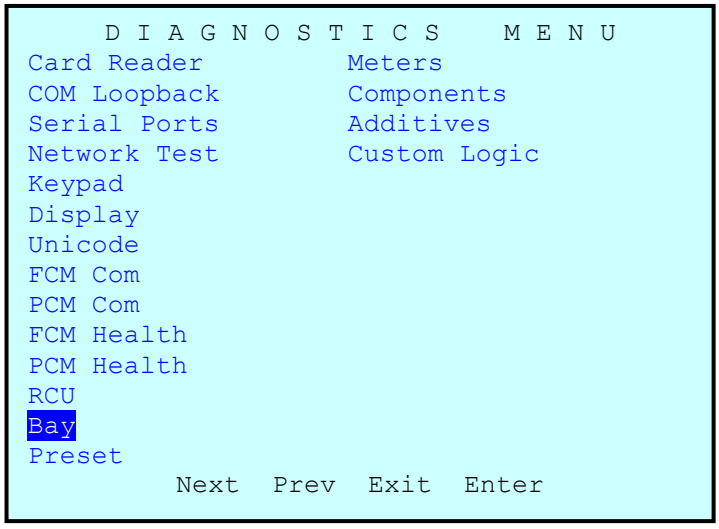

RCU DIAGNOSTICS
Program Key -ON
W&M Key -ON
Exit

8.15 BAY DIAGNOSTICS

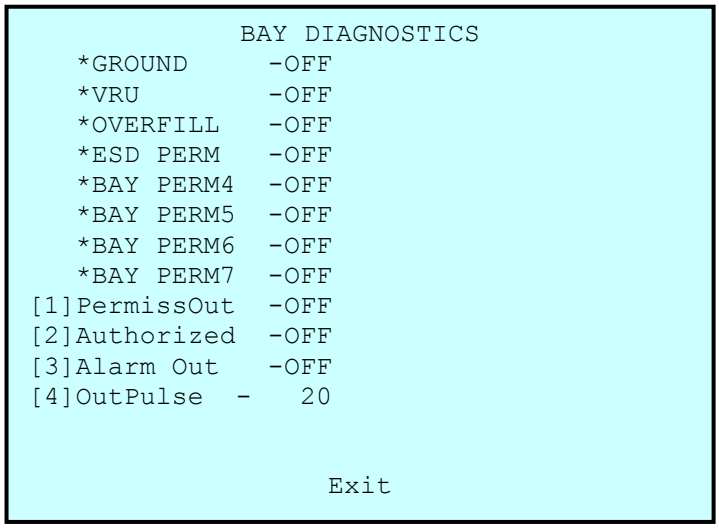
Use the Bay Diagnostics function to determine if:

- the bay permissive input statuses can be viewed as ON or OFF.
- the bay Permissive-Out, Authorized, and Alarm Out outputs can be activated or deactivated from this screen by pressing the number that corresponds to the function.

1. From the Diagnostics Menu, select **RCU**.



2. The Bay Diagnostics screen displays: Only the I/O that is configured will appear on this screen.

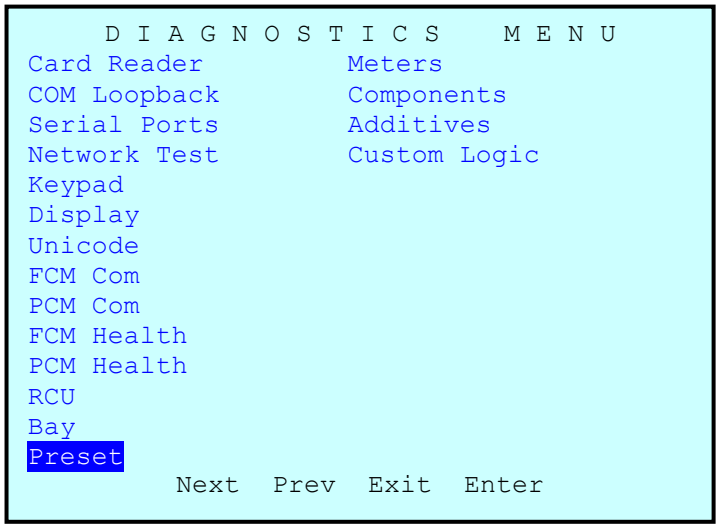


8.16 PRESET DIAGNOSTICS

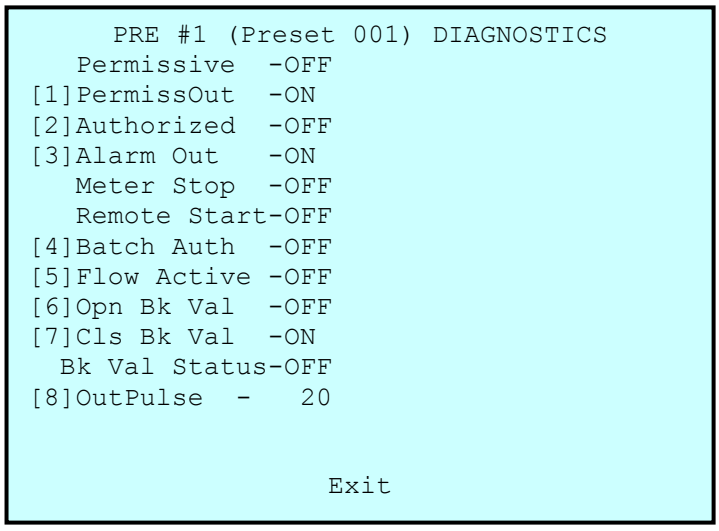
Preset diagnostics enable your technician or electrician to narrow down the problem by showing what is turned on or off.

- input statuses can be viewed as ON or OFF.
- outputs can be activated or deactivated from this screen by pressing the number that corresponds to the function.

1. From the Diagnostics Menu, select **Preset**.



2. The Preset Diagnostics screen displays: Only the I/O that is configured will appear on this screen.

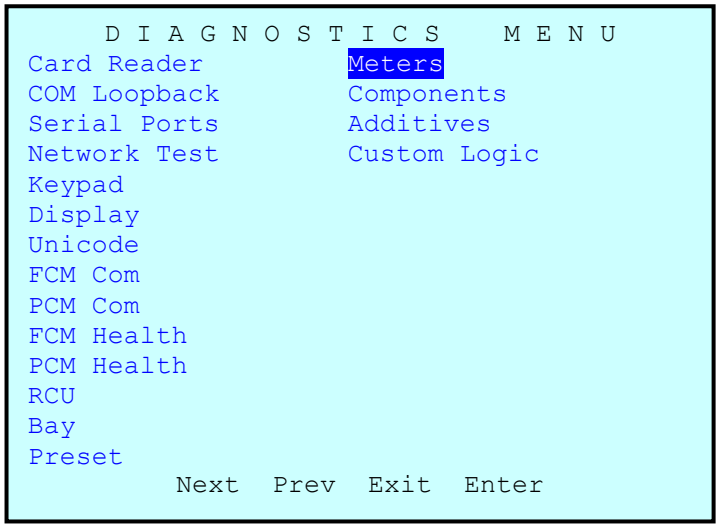


8.17 METER DIAGNOSTICS

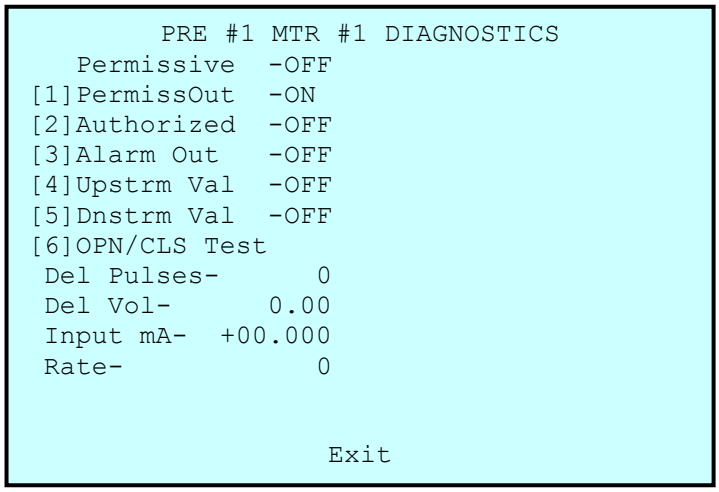
Meter diagnostics enable your technician or electrician to diagnose wiring problems or hardware problems by testing the wiring and control from the MultiLoad II to outside devices such as digital control valves, flow meters, and permissives.

- input statuses can be viewed as ON or OFF.
- outputs can be activated or deactivated from this screen by pressing the number that corresponds to the function.

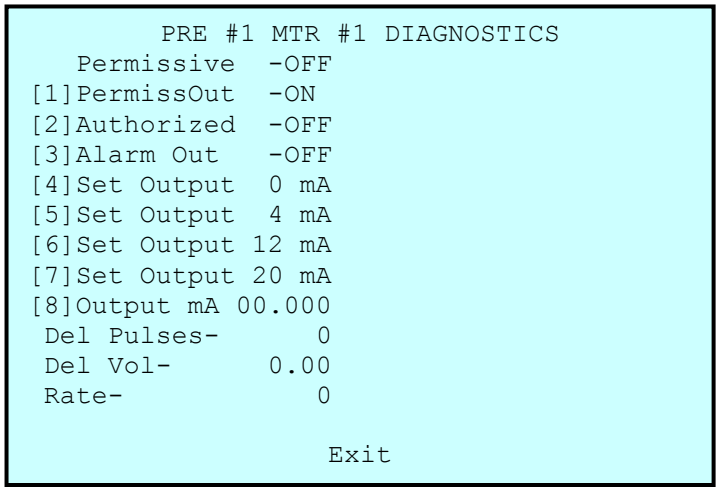
1. From the Diagnostics Menu, select **Meters**.



2. After Selection of the Meter, the Meter Diagnostics screen displays. Only the I/O that is configured will appear on this screen.



If the meter is configured to have an analog valve output, the following screen will appear.

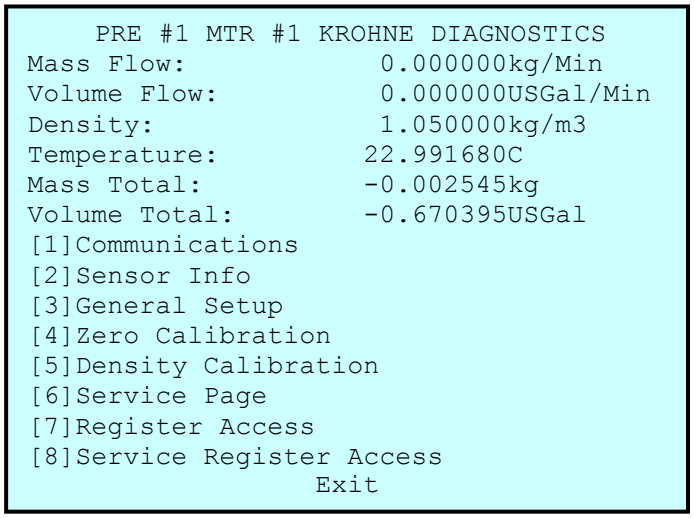


Upstrm Val	Energize or deenergize the upstream solenoid valve.
Dnstrm Val	Energize or deenergize the downstream solenoid valve.
OPN/CLS Test	Start an automated test measuring the control valve opening and closing speeds.
Set Output xx mA	Set mA drive output to xx.
Output mA xx.xxxx	Display or Set mA drive output to xx.xxxx.
Del Pulses	Number of meter pulses received.
Del Volume	Meter volume delivered.
Input mA-	Current meter 4-20mA signal (Analog Meter Input Only).
Rate	Current flow rate.

Turning on both Upstrm Val and Dnstrm Val at the same time will open the digital control valve and may result in flow (if pumps, block valves, and dry breaks are set correctly).

Driving the mA output to any value greater than 4 mA will open the digital control valve and may result in flow (if pumps, block valves, and dry breaks are set correctly).

If the meter is configured as a Krohne mass meter, the following screen will appear:



Mass Flow	The current flow rate in the configured mass flow units.
Volume Flow	The current flow rate in the configured volume flow units.
Density	The current density in the configured density units.
Temperature	The current temperature in the configure temperature units.
Mass Total	The total mass of product flowed since power on of the mass meter.
Volume Total	The total volume of product flowed since power on of the mass meter.

If the meter is configured as a Micro Motion mass meter, the following screen will appear:

```
    PRE #1 MTR #1 MICRO MOTION METER

    Mass Flow Rate:      xxxxx.xx kg/hr
    Mass Total:      xxxxxxxxx.xx kg

    Volume Flow Rate:     xxxx.xx l/hr
    Volume Total:    xxxxxxxxx.xx l

    Temperature:          xxxx.xx C
    Density:                xx.xxxxxx


[1]Broadcast Address Set #01:OFF
[2]Perform Flowmeter Zeroing:OFF
[3]Perform Totalizer Reset:  OFF
                Exit
```

Upstrm Val	Energize or deenergize the upstream solenoid valve.
Dnstrm Val	Energize or deenergize the downstream solenoid valve.
OPN/CLS Test	Start an automated test measuring the control valve opening and closing speeds.
Set Output xx mA	Set mA drive output to xx.
Output mA xx.xxxx	Display or Set mA drive output to xx.xxxx.
Del Pulses	Number of meter pulses received.
Del Volume	Meter volume delivered.
Input mA-	Current meter 4-20mA signal (Analog Meter Input Only).
Rate	Current flow rate.

8.18 DIGITAL CONTROL VALVE TEST

MultiLoad II contains an Open/Close valve test in the Meter Diagnostics screen. This test will automatically open the digital control valve until the high flow rate is achieved. When the high flow rate is achieved, the digital control valve will be commanded to close. The Opening and Closing times are measured and displayed to provide guidance in adjusting the speed control settings.

To perform the test, liquid must flow through the valve. Therefore, an appropriate receptacle must be provided to receive the product flow. Ensure that there is enough volume in the receptacle to accommodate test flows. Each test will deliver about 50 gallons with a properly operating control valve. Keep a log of the totals delivered for each test. Volumes delivered will be categorized as unauthorized flow.

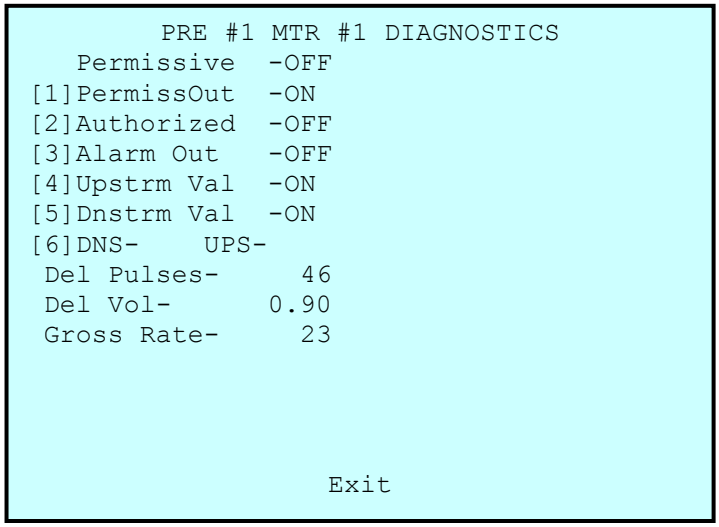
Upon initiating the test, the flow rate will be immediately ramped up to the High Flow Rate, without a Low Flow Start phase. Consult the terminal's safety procedures for loading hydrocarbon's into an empty vessel.

Be prepared to manually stop flow through alternate means (dry brake) if the valve has been malfunctioning or adjustments are being made. Press any key to abort the test.

The following procedure can be used to determine the opening and closing speeds of the digital control valve.

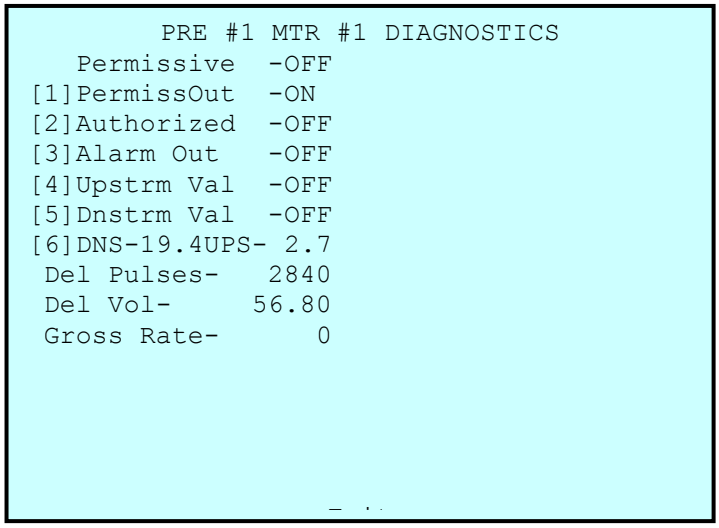
1. At the MultiLoad II, enter Program mode and select the Diagnostic menu.
2. Energize the pump of the desired component:
   a) From the Diagnostic screen select Components.
   b) Select the preset that is under test. Select the desired component for the valve that is under test.
   c) Press the number that corresponds to Pump Run. This should start the pump if power is enabled by all intermediary devices, such as PLCs. Depending on the site configuration, it may be necessary to open component block valves. If appropriate, press the number that corresponds to Opn Blk Val.
   d) Press the Enter key to jump into the Meter Diagnostic Menu.
3. Start the test:
   a) On the Meter Diagnostic screen (see next page), make sure that all preparations have been made to accommodate product flow.

      Press the number that corresponds to OPN/CLS Test; the screen will indicate that the upstream and downstream solenoids are energized (ON). Product will begin to flow; pulses and volume will begin to accumulate, as indicated on the diagnostic screen.



b) The flow rate will begin to increase from zero, as indicated on the diagnostic screen. The flow rate will continue to increase until the High Flow Rate is reached.

c) As soon as the High Flow Rate is reached, both solenoids will automatically de-energize and their valves will return to their normal state. The upstream solenoid valve will return to the open condition and the downstream solenoid valve will return to the closed position. When flow has dropped to zero, the test is complete.



Valve will remain open until the High Flow Rate is reached. If the High Flow Rate cannot be obtained, stop flow by pressing any key. Determine why the High Flow Rate cannot be reached before resuming the test.

4. Read the Opening and Closing Times

    a) DNS: The numbers to the right of this designation indicate the opening speed in seconds. Target should be above 10 seconds but less than 20 seconds. The Downstream needle valve will set this time. Close to increase this time, open to decrease this time.

    b) UPS: The numbers to the right of this designation indicate the closing speed in seconds. Target should be above 1.5 seconds but less than 2.5 seconds. The Upstream needle valve will set this time. Close to increase this time, open to decrease this time.

It may be desirable to repeat step three a number of times to get an average response. A running total of the delivered volume will be maintained if Exit is not pressed in between tests.

5. Determine if opening and closing speeds fall within values recommended by the valve manufacturer. If appropriate opening and closing times are achieved, exit the Diagnostic mode and perform a typical loading sequence in order to evaluate flow performance. If the values fall outside of these ranges, make ¼-turn adjustments as described below. Repeat steps 3 through 5 until speeds are as desired.

    a) Increase closing speed-If it is necessary to increase the closing speed (UPS), adjust the closing speed needle valve ¼-turn counter-clockwise (CCW). This is the needle valve on the upstream side of the assembly.

    b) Decrease closing speed- If it is necessary to decrease the closing speed (UPS), adjust the closing speed needle valve ¼-turn clockwise (CW). This is the needle valve on the upstream side of the assembly.

    c) Increase opening speed-If it is necessary to increase the opening speed (DNS), adjust the opening speed needle valve ¼-turn counter-clockwise (CCW). This is the needle valve on the downstream side of the assembly.

    d) Decrease opening speed-If it is necessary to Decrease the opening speed (DNS), adjust the opening speed needle valve ¼-turn clockwise (CW). This is the needle valve on the downstream side of the assembly.

6. Stop the pump - To stop the pump and close the block valve, press exit until the Diagnostic Screen is reached.

    a) From the diagnostic screen select Components.

    b) Select the preset that is under test. Select the desired component for the valve that is under test.

    c) Press the number that corresponds to Pump Run. This should stop the pump. Depending on the site configuration, it may be necessary to close the component block valve. If appropriate, press the number that corresponds to Opn Blk Val.

    d) Press Exit until the MultiLoad II re-boots (exit program mode).

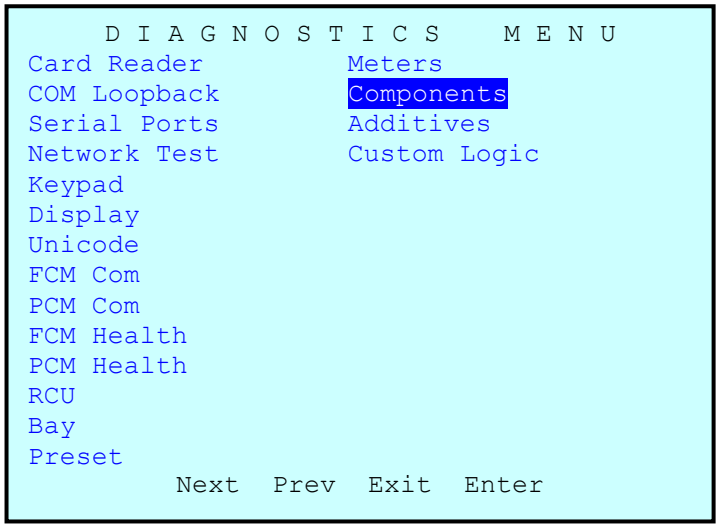
Note: If you re-boot (exit program mode) without stopping the pump or closing the block valve, these devices will automatically de-energize.

8.19 COMPONENT DIAGNOSTICS

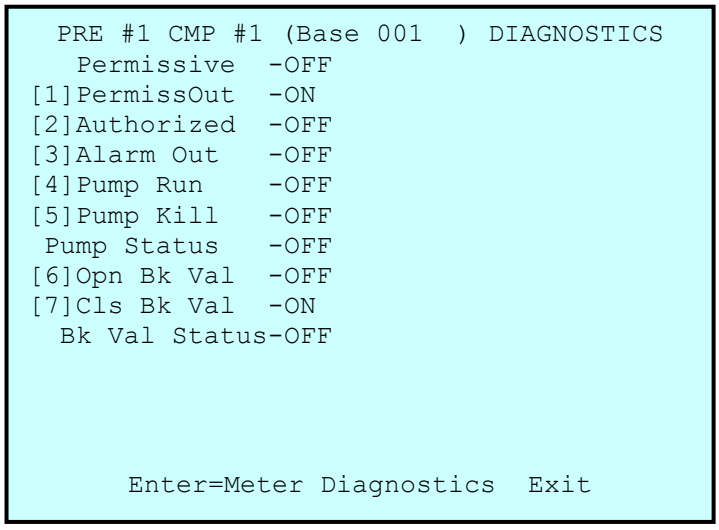
Component diagnostics enable your technician or electrician to diagnose wiring problems or hardware problems by testing the wiring and control from the MultiLoad II to outside devices such as block valves, pump runs/status, and permissives.

- input statuses can be viewed as ON or OFF.
- outputs can be activated or deactivated from this screen by pressing the number that corresponds to the function.

1. From the Diagnostics Menu, select **Components**.



2. After Selection of the Component, the Component Diagnostics screen displays. Only the I/O that is configured will appear on this screen.



To view diagnostics for the meter associated with this component, press Enter.

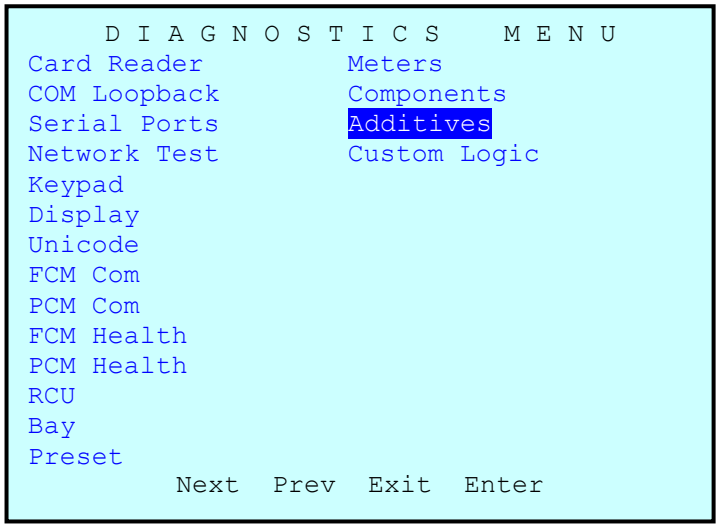
Going to Meter Diagnostics from this screen allows valve control after starting pumps and opening block valves.

8.20 ADDITIVE DIAGNOSTICS

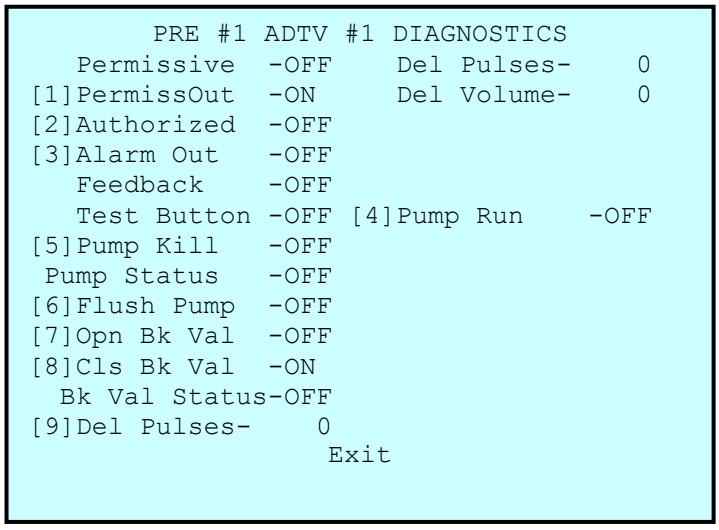
Additive diagnostics enable your technician or electrician to diagnose wiring problems or hardware problems by testing the wiring and control from the MultiLoad II to outside devices such as block valves, pump runs/status, injector outputs/inputs and permissives.

- input statuses can be viewed as ON or OFF.
- outputs can be activated or deactivated from this screen by pressing the number that corresponds to the function.

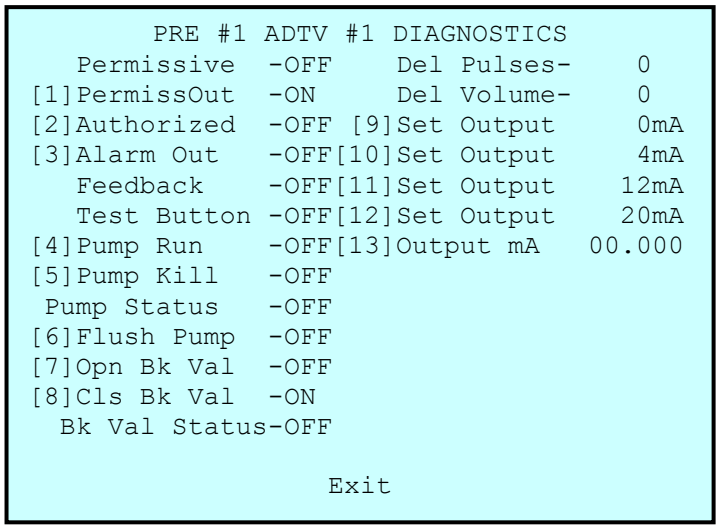
1. From the Diagnostics Menu, select **Additives**.



2. After Selection of the Additive, the Additive Diagnostics screen displays. Only the I/O that is configured will appear on this screen if it is not the analog additive.



If the analog additive is configured following screen will appear, where the pump speed can be controlled with the analog output.


PRE #1 ADTV #1 DIAGNOSTICS
Permissive -OFF
[1]PermissOut -ON
[2]Authorized -OFF
[3]Alarm Out -OFF
Feedback -OFF
Test Button -OFF
[4]Pump Run -OFF
[5]Pump Kill -OFF
Pump Status -OFF
[6]Flush Pump -OFF
[7]Opn Bk Val -OFF
[8]Cls Bk Val -ON
Bk Val Status-OFF
Del Pulses- 0
Del Volume- 0
[9]Set Output 0mA
[10]Set Output 4mA
[11]Set Output 12mA
[12]Set Output 20mA
[13]Output mA 00.000
Exit

Feedback	Reads the Pulse or Feedback signal that verifies that the piston has been launched and has returned to its starting position.
Test Button	Reads the test button signal. (See "Additive Calibration" topic in Chapter 6.)
Pump Run	Turns on or off an output signal to an additive pump starter. The additive pump output will remain energized until the load is completed, unless a Valve Fault Alarm occurs.
Pump Kill	Turns on or off an output signal to stop the additive pump. The Pump Kill signal only becomes active when the system experiences an additive Valve Fault Alarm.
Pump Status	Reads the Pump Status signal, which indicates if the additive pump is running or not. If this signal is absent for the period specified in the Pump Status Alarm Time parameter, the additive's Pump Status Alarm will be raised.
[x]Del Pulses	Initiates an injection. The number of additive meter pulses expected from the injection will appear to the right.
Del Pulses	Number of additive pulses received from the additive meter.
Del Volume	Total additive volume injected.

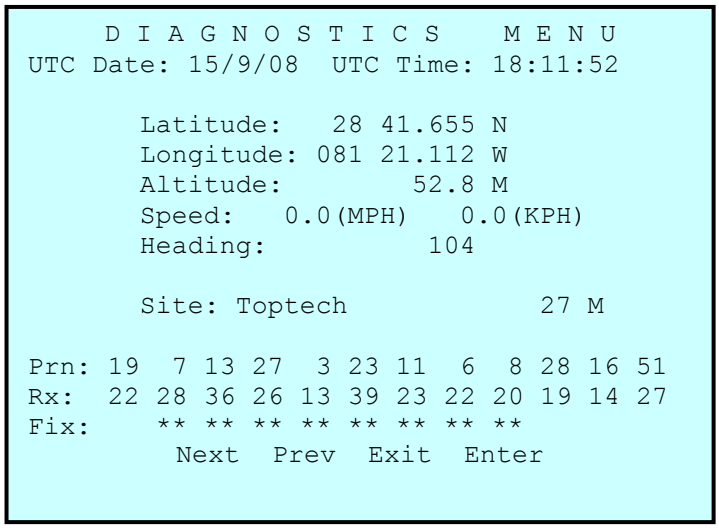
8.21 CUSTOM LOGIC

The Custom Logic Diagnostics function is used for any customized diagnostic tools or functions required by your company or your particular terminal. If, at any time, you wish to include custom logic, please contact Toptech Account Management.

The Custom Logic Diagnostics function is covered later in this User Guide.

8.22 GPS DIAGNOSTICS (ML II MOBLE ONLY)

GPS diagnostics displays the current detailed status of the connected GPS.


D I A G N O S T I C S M E N U
UTC Date: 15/9/08 UTC Time: 18:11:52
Latitude: 28 41.655 N
Longitude: 081 21.112 W
Altitude: 52.8 M
Speed: 0.0(MPH) 0.0(KPH)
Heading: 104
Site: Toptech 27 M
Prn: 19 7 13 27 3 23 11 6 8 28 16 51
Rx: 22 28 36 26 13 39 23 22 20 19 14 27
Fix: ** ** ** ** ** ** ** **
Next Prev Exit Enter

UTC Date	The current Universal Coordinated Time (UTC) Date reported by the GPS.
UTC Time	The current Universal Coordinated Time (UTC) Time reported by the GPS.
Latitude	The current Latitude reported by the GPS.
Longitude	The current Longitude reported by the GPS.
Altitude	The current Altitude above sea level reported by the GPS.
Heading	The current heading reported by the GPS. Note: This value is computed by movement, not vehicle orientation.
Site	When configured, will report the site name and distance from the current position.
Prn	The Pseudo Random Noise (PRN) Code reported for each SV (Space Vehicle) signal received by the GPS.
Rx	The Received signal strength of each SV signal received. Higher the number, the stronger the signal.
Fix	As reported by the GPS, the "**" indicates that the corresponding SV signal is being used to compute the current position fix.

CHAPTER 9 WEIGHTS AND MEASURES

9.1 OVERVIEW

9.1.1 WEIGHTS AND MEASURES

The Weights and Measures key/switch/plug may be lead-sealed or locked, preventing access to all Weights and Measures protected parameters. All parameters that are W&M protected will appear red on the MultiLoad RCU display.

You may need to contact your local Weights and Measures office after breaking the seal and changing parameters. This is typically done only during meter proving or temperature calibration procedures at the terminal.

9.2 ACCESS RESTRICTIONS TO W&M PARAMETERS

MultiLoad II uses three methods of write-access to the W&M parameters.

- Manual entry of W&M parameters, via the keypad on the MultiLoad II.
- Remote upload of parameters via the host serial or Ethernet link on the MultiLoad II.
- Upload of parameters via a SD memory card on the MultiLoad II (Rev 2.0 CPU board only).

In all cases, write access to W&M parameters is denied unless the W&M key/switch/plug is in the W&M access position.

To perform a remote upload of metrological parameters, the W&M key/switch/plug MUST be in the W&M access position otherwise all remote attempts to modify the W&M parameters will be rejected.

The MultiLoad II enclosure has a location where a lead seal can be placed to ensure that any tampering with the MultiLoad II internals to access the field connections, CPU, configuration memory or switch electronics directly will be evident.

MultiLoad II uses two methods of firmware update.

- Remote upload of a new firmware image via the host serial or Ethernet link on the MultiLoad II.
- Upload of a new firmware image via a SD memory card on the MultiLoad II (Rev 2.0 CPU board only).

In all cases, attempts to upgrade the firmware of the MultiLoad will be denied unless the W&M key/switch/plug is the in the W&M access position.

To perform a remote update of the firmware, the program/W&M key/switch/plug MUST be in the W&M access position otherwise all remote attempts to update the firmware will be rejected.

Any W&M parameter changes or firmware updates that are made will be logged into the W&M change log. Up to five passwords can be stored for access; each password has an identifying character that can be assigned to an individual operator.

The MultiLoad II has the ability to support a remote customer supplied Program Mode and/or W&M Mode switches. When this is done, the customer will be responsible for all sealing requirement on these external switches and wiring as required by the local Metrology Authority.

9.3 WEIGHTS & MEASURES CHANGE LOG AND METROLOGICAL PARAMETER SECURITY

The last 1,000 Weights and Measures (W&M) parameter changes are logged in the MultiLoad's Non-Volatile RAM (NVRAM). Write access to these registers is restricted by software means. When all conditions are met for changing a W&M parameter, a single write is allowed only after creating a new entry to the W&M change log, which records the following information about the parameter change:

- Date
- Time
- Parameter name
- Event number
- Identifying character
- Affected preset (load arm)
- Affected flow meter
- Affected component
- Previous value
- New value

The W&M change log is stored in the MultiLoad NVRAM and cannot be edited or modified.

9.4 VOLUME CORRECTION FACTOR FEATURES

The MultiLoad II has the ability to calculate net volumes. Net volume, for the purposes of this discussion, is defined to be the gross volume corrected to a reference temperature and/or a vapor pressure. The net volume is calculated by multiplying the gross volume by a Volume Correction Factor (VCF). In MultiLoad II applications, the VCF is the product of two different factors. These factors are the Correction factor for Temperature of Liquid (CTL) and the Correction factor for Pressure of Liquid (CPL). The CTL and CPL features can be enabled simultaneously or they can be enabled independent of each other.

VCF = CTL x CPL

Gross volume is the Raw Volume multiplied by a meter factor (MF). The Raw Volume is the unfactored meter pulses divided by the flow meter's K-factor. The units of the K-factor are pulses per unit of volume. For example, the K-factor of a 3-inch turbine flow meter is 50 pulses per gallon, nominally. The sequence below can be used to conceptualize how pulses from a flow meter are used to determine Raw Volume, Gross Volume and Net Volume.

Raw Volume = Pulses/K-factor or Raw Volume = (Pulses) x (1/K-factor)

Gross Volume = Raw Volume x MF

Net Volume = Gross Volume x VCF

CTL Calculation - Tables established by the American Petroleum Institute (API) are used to provide the Correction factor for Temperature of Liquid (CTL). MultiLoad II calculates the CTL in accordance with API Standard 2540. The CTL is used to correct the Gross Volume to a volume at a reference temperature. After applying the CTL to the gross volume, the resulting net volume represents the volume that the gross volume would occupy if it were measured at the reference temperature.

Selected API tables are available in MultiLoad II to be used for specific liquids and specific reference temperatures. All of the calculations make use of two variables; the variables are the Alpha of the liquid and the Delta Temperature of the liquid.

Alpha is the coefficient of expansion of the liquid.

Delta Temperature is the difference between the measured temperature of the liquid and the reference temperature. The API tables employed use reference temperatures of 60° F or 15° C.

Some API tables calculate the Alpha based on the liquid temperature and the API gravity of the liquid. The API gravity is a user entered value, which is dependent on the type of liquid being measured. Other API tables calculate the Alpha based on the liquid temperature and the relative density of the liquid. Still other tables calculate the Alpha based on the liquid temperature and the density of the liquid. Liquid density, like API gravity, is dependent on the type of liquid being measured. In the "C" tables, Alpha is user entered.

CPL Calculation- The Correction factor for Pressure of Liquid (CPL) is used to correct the Gross Volume to a volume at the liquid's vapor pressure. After applying the CPL to the Gross Volume, the resulting net volume represents the area that the liquid would occupy if the liquid were at its vapor pressure.

The calculation for CPL involves three variables: Variables include the current liquid pressure, the liquid's vapor pressure and the F-factor of the liquid.

Current Pressure is the pressure of the liquid. This is a measured variable and will require that a pressure transducer be employed to provide pressure information to a Flow Control Module (FCM) in the form of a 4-20 mA signal.

Vapor Pressure is the pressure at which the liquid changes to vapor at the current liquid temperature. Vapor pressure is also referred to as equilibrium pressure and bubble point. TP-15 is used to determine the vapor pressure.

F-factor is the compressibility factor of the liquid. API tables 11.2.1 and 11.2.2 are used to compute the F-factor.

9.5 MASS CALCULATIONS

The MultiLoad II has the ability to calculate mass. Mass, for the purposes of this discussion, is defined to be the net volume corrected to a density. The mass is calculated by multiplying the net volume by a density. There are 3 types of densities which can be used.

1/ Density

2/Relative Density
3/ API Gravity

The Density used in the mass formula follows the following rule.

If an API table is selected the API table determines the density
If no API table is selected the following rulez are going into affect.

- Check if there is a default density or relative density or API gravity

If not

- Check if a meter sensor is enabled for density or relative density or API gravity

If not

- Check if there is a default meter density or relative density or API gravity

This formular is used when we have a default density, relative density or API Gravity

Mass = Net Volume x Density

This formular is used when we measure the observed density

Mass = Net Volume x Density

Note:
Kilogram Air will change the density with -1.1 for products under a density of 996.6 , between 996.6 and 1663.5 we use a density change of -1.0 and everything above 1663.5 will be -0.9.

9.5.1 NET PULSE OUTPUT

There is a provision to produce a net pulse output. A factor can be applied to the net pulse output to achieve the desired pulse resolution. The pulse resolution can be configured from 0.001 to 50.000 pulses per unit volume. The Net Output Pulse configuration parameter is found under Preset Setup.

9.5.2 MASS PULSE OUTPUT

There is a provision to produce a mass pulse output. A factor can be applied to the mass pulse output to achieve the desired pulse resolution. The pulse resolution can be configured from 0.001 to 50.000 pulses per unit volume. The Mass Output Pulse configuration parameter is found under Preset Setup.

9.5.3 DELIVER IN GROSS OR NETOR MASS

Each load arm can be configured to deliver in either gross ,net volume or mass. If a preset is configured to deliver in gross, preset quantities will be entered in gross. A preset that is configured to deliver in net volume will accept preset quantities in net volume. A preset that is configured to deliver in mass will accept preset quantities in mass. Each preset in the bay can be configured independently of the others for gross ,net or mass delivery. The Deliver Typ feature is in the Weights & Measures/Preset menu.

9.5.4 API TABLE VCF CALCULATORS

In the configuration menus of the API TABLE functions, it is possible to enter test values of variables that are used to calculate the Vcf factors. For example, when using a CTL table that relies on a user entered density or gravity and a measured temperature, a test temperature can be entered to determine the CTL that would be calculated at that temperature and gravity. Similarly, the tables used in conjunction with CPL will permit the entry of test temperatures and test pressures in order to determine the resulting CPL. The configuration menu and calculator for CTL can be found under Weights & Measures/API TABLE in the program mode. The configuration menu and calculator for CPL can be found under Weights & Measures/API TABLE in the program mode.

If valid test data (temperature and pressure) are within the range of the selected API table, the bottom line will display Calculated Vcf. In some cases the bottom line may display an Extrapolated Vcf. This means that the table is producing a factor that was not obtained by experimentation; the factor is in the extrapolated region of the table, as recommended by API. When the test data and gravity are beyond the recommended range of the selected table, the bottom line will display API Input Data Out of Range!

The test temperature, density and pressure will not be used by the API table when flowing product. The gravity that is entered is a value that will be used by the table under operating conditions.

9.5.5 DISPLAY OF NET VOLUME AND RELATED DATA

Whenever the CTL or CPL function is enabled for a preset (load arm), the net volume can be viewed on the Component Detail screen. The Component Detail screen is a sub screen of the Component Status screen. The Component Detail screen will also display the current CTL and CPL. Additionally, the Component Detail screen will display one of the following variables appropriate to the selected API table: API gravity, density, relative density or coefficient of expansion. If the Deliver in Net feature is disabled, volumes on the Load screen and the Control screen are gross values. By enabling the Deliver in Net feature, volumes on the Load screen and the preset's Control screen will be net values. Preset quantities will then be entered as net quantities and delivery will be in net volume. The Control screen will display a message that indicates the units of volume and the reference temperature to which the volume has been corrected.

The Component Detail screen is accessed from the Component Status screen. A Component Detail screen can be viewed for each component that is listed on the Status screen. From the Component Status screen, press Next to view the Component Detail screen for each component.

The Views and Inquiry menu permits the observation of current temperatures and pressures, including offsets, without compromising Weights & Measures security. To view a temperature or pressure, enter the program mode and choose the Views and Inquiry menu from the main configuration menu. Select Temperature or Pressure as desired. Then, choose the desired load arm and associated flow meter.

9.5.6 API MPMS CHAPTER 11.1-2004/ADJUNCT TO IP 200/04/ADJUNCT TO ASTM D 1250-04

MultiLoad II firmware as of version 4.31.04 supports API MPMS Chapter 11.1-2004/Adjunct to IP 200/04/Adjunct to ASTM D 1250-04, referred to hereafter as the 2004 standard. Advantages over the 1980 standard include an addition digit of accuracy and correction to an arbitrary reference temperatures or gravity. These methods can be used to recreate corrections factors in the manner of the historic tables with the appropriate inputs.

9.5.7 CONFIGURING FOR TEMPERATURE CORRECTION (CTL)

MultiLoad II firmware supports several different petroleum measurement tables used to produce CTL. Selection of the appropriate table depends on the type of product, the density units of measure used, and the temperature to which the volume will be corrected.

Enter the program mode and select the View and Inquiries menu. From the View and Inquiries menu select Temp Comp. Select the desired preset. Select the desired component. Each component of a given preset will need to be configured independently for CTL.

1. Select the API CTL table

Highlight this field and press **Enter** to scroll through the table choices. When the desired table appears, press **Next** to advance to the following field. Below is a list of API Table options and the conditions under which they are used. If the name in red NMI is in, it means that the table is approved for MID purposes.

Table	Description
ASTM1250-1980 Table 6A	This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 60° F. Use this table if the following conditions exist. The liquid is crude oil API Gravity @ 60 °F is known Reference Temperature is 60° F After selecting this table, enter the API Gravity of the liquid at 60° F. The valid range of API Gravity is from 0-100 °API. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the API Gravity. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

Table	Description
ASTM1250-1980 Table 6B	This table provides CTL factors for correcting volumes of gasolines at observed temperatures to the volume at 60° F. Use this table if the following conditions exist. The liquid is a refined product API Gravity @ 60 °F is known Reference Temperature is 60° F After selecting this table, enter the API Gravity of the liquid at 60° F. The valid range of API Gravity is from 0-85 °API. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the API Gravity. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-1980 Table 6C	This table provides CTL factors for correcting volumes of petroleum liquids at observed temperatures to the volume at 60° F. Use this table if the following conditions exist. The liquid is a refined product or crude oil Coefficient of Expansion @ 60° F is known Reference Temperature is 60° F After selecting this table, enter the Coefficient of Thermal Expansion (alpha) of the liquid at 60° F. The valid range of alpha is from 0.000270-0.000930. The alpha will be entered as 270-930, however. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the alpha. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-1980 Table 6D	This table provides CTL factors for correcting volumes of lube oils at observed temperatures to the volume at 60° F. Use this table if the following conditions exist. The liquid is a lube oil API Gravity @ 60 °F is known Reference Temperature is 60° F After selecting this table, enter the API Gravity of the liquid at 60° F. The valid range of API Gravity is from -10 to 45 °API. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the API Gravity. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-1980 Table 23E	This table provides density at 60° F of light hydrocarbons at observed temperature and density. Use this table if the following conditions exist. The liquid is a NGL or LPG (propane) Current Temperature and Density is available. Relative Density at 60° F is unknown Reference Temperature is 60° F Test temperatures and densities can be entered on this screen that will calculate the corrected density at the test temperature and density. The test temperature, density and Calculated corrected density at 60° F are for informational purposes and will not be used in calculations during operations. NOTE: This table will not produce a CTL value, but this table may be used by other tables.

Table	Description
ASTM1250-1980 Table 24A	This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 60° F. Use this table if the following conditions exist. The liquid is crude oil Relative Density at 60° F is known Reference Temperature is 60° F After selecting this table, enter the Relative Density of the liquid at 60° F. The valid range of Relative Density is from 0.6110-1.0760. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Relative Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-1980 Table 24B	This table provides CTL factors for correcting volumes of gasolines at observed temperatures to the volume at 60° F. Use this table if the following conditions exist. The liquid is a refined product Relative Density at 60° F is known Reference Temperature is 60° F After selecting this table, enter the Relative Density of the liquid at 60° F. The valid range of Relative Density is from 0.6535-1.0760. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Relative Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-1980 Table 24E	This table provides CTL factors for correcting volumes of light hydrocarbons at observed temperatures to the volume at 60° F. Use this table if the following conditions exist. The liquid is a NGL or LPG (propane) Relative Density at 60° F is known Reference Temperature is 60° F After selecting this table, enter the Relative Density of the liquid at 60° F. The valid range of Relative Density is from 0.3500-0.6880. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Relative Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-1980 Table 53B **NMI**	This table is used to correct observed density at the observed temperature to a density at 15° C. When this table is activated, the corrected density is then automatically used in Table 54B, which provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a refined product Observed Density is to be corrected to 15° C and used in Table 54B Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at the observed temperature. The valid range of Density is from 653-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

Table	Description
ASTM1250-1980 Table 54 **NMI**	This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is crude oil Density at 15° C is known Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 500-600 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-1980 Table 54A **NMI**	This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is crude oil Density at 15° C is known Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 610-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations. NOTE: Enabling the “Canada API Limits” bay parameter will extend the temperature range down to -40° C in accordance with Measurement Canada Bulletin: V-18-E rev.3 1999-09-19 section 270.
ASTM1250-1980 Table 54B **NMI**	This table provides CTL factors for correcting volumes of gasoline’s at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a refined product Density at 15° C is known (use table 53B if Density at observed temperature is used) Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 653-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations. NOTE: Enabling the “Canada API Limits” bay parameter will extend the temperature range down to -40° C in accordance with Measurement Canada Bulletin: V-18-E rev.3 1999-09-19 section 270.
ASTM1250-1980 Table 54C **NMI**	This table provides CTL factors for correcting volumes of petroleum liquids at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a refined product or crude oil Coefficient of Expansion @ 15° C is known Reference Temperature is 15° C After selecting this table, enter the Coefficient of Thermal Expansion (alpha) of the liquid at 15° C. The valid range of alpha is from 0.000486-0.001674. The alpha will be entered as 486-1674, however. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the alpha. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations. NOTE: Enabling the “Canada API Limits” bay parameter will extend the temperature range down to -40° C in accordance with Measurement Canada Bulletin: V-18-E rev.3 1999-09-19 section 270.

<table>
<tr><th>Table</th><th>Description</th></tr>
<tr><td>ASTM1250-1980 Table 54D

NMI</td><td>This table provides CTL factors for correcting volumes of lube oils at observed temperatures to the volume at 15° C. Use this table if the following conditions exist.
The liquid is a lube oil
Density @ 15° C is known
Reference Temperature is 15° C
After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 800-1064 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
NOTE: Enabling the “Canada API Limits” bay parameter will extend the temperature range down to -40° C in accordance with Measurement Canada Bulletin: V-18-E rev.3 1999-09-19 section 270.</td></tr>
<tr><td>ASTM1250-1980 Table 54AG Germany

NMI</td><td>This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 15° C. Use this table if the following conditions exist.
The liquid is crude oil
Density at 15° C is known
Reference Temperature is 15° C
After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 610-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
<table><tr><th>Density</th><th>Temperature</th></tr><tr><td>(610,5 to 778,5)</td><td>−18 to 95</td></tr><tr><td>(779,0 to 824,0)</td><td>−18 to 125</td></tr><tr><td>(824,5 to 1 075,0)</td><td>−18 to 150</td></tr></table></td></tr>
<tr><td>ASTM1250-1980 Table 54BG Germany

NMI</td><td>This table provides CTL factors for correcting volumes of gasoline’s at observed temperatures to the volume at 15° C. Use this table if the following conditions exist.
The liquid is a refined product
Density at 15° C is known
Reference Temperature is 15° C
After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 600-1200 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
<table><tr><th>Density</th><th>Temperature</th></tr><tr><td>600,0 to 770,4</td><td>−18 to 95</td></tr><tr><td>770,5 to 778,5</td><td>−18 to 95</td></tr><tr><td>778,6 to 787,5</td><td>−18 to 125</td></tr><tr><td>787,6 to 824,0</td><td>−18 to 125</td></tr><tr><td>824,1 to 838,5</td><td>−18 to 150</td></tr><tr><td>838,6 to 1 200,0</td><td>−18 to 150</td></tr></table></td></tr>
<tr><td>ASTM1250-1980 Table 54CG Germany

NMI</td><td>This table provides CTL factors for correcting volumes of petroleum liquids at observed temperatures to the volume at 15° C. Use this table if the following conditions exist.
The liquid is a refined product or crude oil
Coefficient of Expansion @ 15° C is known
Reference Temperature is 15° C
After selecting this table, enter the Coefficient of Thermal Expansion (alpha) of the liquid at 15° C. The valid range of alpha is from 0.000486-0.001674. The alpha will be entered as 486-1674, however. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the alpha. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
<table><tr><th>Expansion</th><th>Temperature</th></tr></table></td></tr>
</table>

	0,000 486 to 0,000 918 −18 to 150 0,000 919 to 0,000 954 −18 to 125 0,000 955 to 0,001 674 −18 to 95
ASTM1250-1980 Table 54DG Germany **NMI**	This table provides CTL factors for correcting volumes of lube oils at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a lube oil Density @ 15° C is known Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 750-1164 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations. **Density** | **Temperature** 750,0 to 1 164,0 | −18 to 170
ASTM1250-1980 Table 54XG Germany **NMI**	This table provides CTL factors for correcting volumes of Gas and Bitumen at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a Gas or Bitumen Density @ 15° C is known Reference Temperature is 15° C The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations. **Density** | **Temperature** 500,0 to 650,0 | −50 to 50 950,0 to 1200,0 | 0 o 250
ASTM1250-1980 Table 54YG Germany	This table provides CTL factors for correcting volumes of Chemicals at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a Chemical Density @ 15° C is known Reference Temperature is 15° C Alpha and K coefficient are known these factors are selected in the Multiload2 via parameter YG Product name. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

Product name	Thermal Coefficient Alpha 15° C	Constant K	Density 15° C	Temperature Range ° C
Propane	0.002850	1.55	507.6	-10 to 40
Propen	0.003095	1.36	523.1	-10 to 40
Butane	0.001900	0.80	584.5	-10 to 40
Isobutan	0.002130	1.00	563.0	-10 to 40
Isobutene	0.002060	1.45	600.1	-10 to 40
Cis-But-2-en	0.001900	0.80	627.0	-10 to 40
Trans-But-2-en	0.001910	1.33	610.1	-10 to 40
But-1-en	0.001955	1.30	602.1	-10 to 40
But-1,3-dien	0.001972	0.80	627.7	-10 to 40
Methanol	0.001155	-0.38	796.1	0 to 40
Ethanol	0.001078	0.86	793.5	-20 to 40
Isopropanol	0.001027	0.93	789.1	0 to 30
Isobutanol	0.000923	0.82	805.6	0 to 30
MTBE	0.001413	0.95	745.6	0 to 30

<table>
<tr><td>NMI</td><td>
<table>
<tr><td>TAME</td><td>0.001204</td><td>1.72</td><td>775.0</td><td>15 to 30</td></tr>
<tr><td>Benzol</td><td>0.001188</td><td>0.68</td><td>884.2</td><td>0 to 30</td></tr>
<tr><td>Toluol</td><td>0.001060</td><td>0.73</td><td>871.6</td><td>0 to 30</td></tr>
<tr><td>o-Xylol</td><td>0.000954</td><td>0.78</td><td>884.3</td><td>0 to 40</td></tr>
<tr><td>m-Xylol</td><td>0.000983</td><td>1.03</td><td>868.4</td><td>0 to 30</td></tr>
<tr><td>p-Xylol</td><td>0.000990</td><td>1.30</td><td>865.3</td><td>15 to 40</td></tr>
</table>
</td></tr>
<tr><td>ASTM1250-1980 Table 59E

NMI</td><td>This table provides density at 20° C of light hydrocarbons at observed temperature and density. Use this table if the following conditions exist.
The liquid is a NGL or LPG (propane)
Current Temperature and Density is available.
Relative Density at 20° F is unknown
Reference Temperature is 20° C
Test temperatures and densities can be entered on this screen that will calculate the corrected density at the test temperature and density. The test temperature, density and Calculated corrected density at 20° C are for informational purposes and will not be used in calculations during operations.
The CTL value is calculated as CTL = Observed Density / Corrected Density at 20° C.</td></tr>
<tr><td>ASTM1250-1980 Table 60o</td><td>This table provides density at 20° C of light hydrocarbons at observed temperature and density</td></tr>
<tr><td>ASTM1250-1980 Table 901A</td><td>This is the table-based volume-correction for Alcohols/Biofuels (Brazil) Reference Standard:ABNT NBR 5992 for Ethanol (901A) It is passed the product api density20 at 60 degrees (api60) and the product temperature in degrees F</td></tr>
<tr><td>Table TEC</td><td>This table provides CTL factors for correcting volumes of ethanol at observed temperatures to the volume at either 15° C or 60° F. Use this table if the following conditions exist:
The liquid is ethanol
Coefficient of expansion at 15° C or 60° F is known
Reference Temperature is 15° C or 60° F
After selecting this table, enter the coefficient of expansion of the liquid at 15° C or 60° F. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and coefficient of expansion. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.</td></tr>
<tr><td>Table TEC ETH US</td><td>This table provides CTL factors for correcting volumes of ethanol at observed temperatures to the volume at either 15° C or 60° F. Use this table if the following conditions exist:
The liquid is ethanol
Coefficient of expansion at 15° C or 60° F is not known
Reference Temperature is 15° C or 60° F
Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and coefficient of expansion. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.</td></tr>
<tr><td>Table TEC ETH B100

NMI</td><td>This table provides CTL factors for correcting volumes of ethanol at observed temperatures to the volume at either 15° C or 60° F. Use this table if the following conditions exist:
The liquid is ethanol
Coefficient of expansion at 15° C or 60° F is not known
Reference Temperature is 15° C or 60° F (needs to be maintained under component level!)
Coefficient of Density is fixed at 0.84*10E-3
Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and coefficient of expansion. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.</td></tr>
</table>

<table>
<tr><td></td><td>NOTE: Blend range from B0 to B100</td></tr>
<tr><td>Table TEC ETH B40

NMI</td><td>This table provides CTL factors for correcting volumes of ethanol at observed temperatures to the volume at either 15° C or 60° F. Use this table if the following conditions exist:
The liquid is ethanol
Coefficient of expansion at 15° C or 60° F is not known
Reference Temperature is 15° C or 60° F (needs to be maintained under component level!)
Coefficient of Density is fixed at 0.84*10E-3
Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and coefficient of expansion. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

NOTE: Blend range from B0 to B40</td></tr>
<tr><td>Table TEC ETH E40

NMI</td><td>This table provides CTL factors for correcting volumes of ethanol at observed temperatures to the volume at either 15° C or 60° F. Use this table if the following conditions exist:
The liquid is ethanol
Coefficient of expansion at 15° C or 60° F is not known
Reference Temperature is 15° C or 60° F (needs to be maintained under component level!)
Coefficient of Density is fixed at 1.27*10E-3
Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and coefficient of expansion. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

NOTE: Blend range from E0 to E40</td></tr>
<tr><td>Table TEC ETH E100

NMI</td><td>This table provides CTL factors for correcting volumes of ethanol at observed temperatures to the volume at either 15° C or 60° F. Use this table if the following conditions exist:
The liquid is ethanol
Coefficient of expansion at 15° C or 60° F is not known
Reference Temperature is 15° C or 60° F (needs to be maintained under component level!)
Coefficient of Density is fixed at 1.14*10E-3
Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and coefficient of expansion. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

NOTE: Blend range from E60 to E100</td></tr>
<tr><td>Table PTB-BIO</td><td>This API BIO tables are used for Methode3 from the PTB Community. Select PTB-BIO table combined with API BIO to choose the wanted product.
Formula: V(T) = V0 *{1 + [A1 *(T – T0) + A2 *(T – T0)2 + A3 *(T – T0)3]}
V_0 = Volume @ base temperature
V(T) = Volume @ observed temperature
T_0 = Base Temperature (15° C)
T = Observed Temperature
A1, A2, A3 = Biofuel coefficients

<table>
<tr><th>Product Type</th><th>A1</th><th>A2</th><th>A3</th><th>Ref. Density</th></tr>
<tr><td>E5</td><td>-1.2422×10^{-3}</td><td>-9.1811×10^{-7}</td><td>-5.3906×10^{-9}</td><td>738.858</td></tr>
<tr><td>E10</td><td>-1.2415×10^{-3}</td><td>-9.8712×10^{-7}</td><td>-6.6333×10^{-9}</td><td>741.447</td></tr>
<tr><td>E80</td><td>-1.1129×10^{-3}</td><td>-6.5049×10^{-7}</td><td>-8.8556×10^{-9}</td><td>781.410</td></tr>
</table>
</td></tr>
</table>

	E85	-1.1023×10^{-3}	-6.0110×10^{-7}	-8.7249×10^{-9}	784.549
	E100	-1.0720×10^{-3}	-4.5474×10^{-7}	-8.3383×10^{-9}	793.949
	Benzin/Petrol	-1.2361×10^{-3}	-6.7788×10^{-7}	-3.8516×10^{-9}	733.919
	Diesel	-8.2239×10^{-4}	5.1745×10^{-8}	-1.3703×10^{-9}	844.615
	B5 RME	-8.2261×10^{-4}	5.5270×10^{-8}	-1.3289×10^{-9}	846.439
	B7 RME	-8.2258×10^{-4}	5.4729×10^{-8}	-1.3921×10^{-9}	847.171
	B100 RME	-8.2330×10^{-4}	1.4698×10^{-7}	-1.6545×10^{-9}	883.314
	B5 SME	-8.1922×10^{-4}	2.9212×10^{-8}	-1.0385×10^{-9}	846.486
	B7 SME	-8.1925×10^{-4}	3.1305×10^{-8}	-1.0918×10^{-9}	847.253
	B100 SME	-8.2132×10^{-4}	1.0329×10^{-7}	-1.0793×10^{-9}	885.229

RME: Rapeseed oil methyl ester
SME: Soy bean oil methyl ester

TABLE ETH BRAZIL

This table provides CTL factors for correcting volumes of ethanol at observed temperatures to the volume at 20° C . Use this table if the following conditions exist:

The liquid is alcohol
Alcohol Percentage is known
Current Temperature is available.

Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the alcohol percentage. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

Corrected density at 20 degrees will be calculated and stored.

TABLE HYDRO BRAZIL

This table provides CTL factors for correcting volumes of hydrocarbons at observed temperatures to the volume at 20° C . Use this table if the following conditions exist:

The liquid is alcohol
Current Temperature and Density at 20° C is available.

Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

Product	Min Temp	Max Temp	Min Dens20	Max Dens20
LPG	-50	75	498	700
Gasoline	-25	75	700	800
Diesel, Lubes	-25	125	800	900
Crude Oil, heavy oils, …	0	200	900	1200

Corrected density at observed degree will be calculated and stored.

ASTM 1250-2004 Table 5A **NMI**	This table provides the API gravity at 60° F of crude oil at observed temperature and API gravity. Use this tables if the following conditions exist: The liquid is crude oil Current temperature and API gravity is known API gravity at 60° F is unknown
ASTM 1250-2004 Table 5B **NMI**	This table provides the API gravity at 60° F of refined products at observed temperature and API gravity. Use this table if the following conditions exist: The liquid is a refined product Current temperature and API gravity is known API gravity at 60° F is unknown
ASTM1250-2004 Table 5D **NMI**	This table provides the API gravity at 60° F of lubrication oil at observed temperature and API gravity. Use this table if the following conditions exist: The liquid is lubrication oil Current temperature and API gravity is known API gravity at 60° F is unknown
ASTM1250-2004 Table 5X	This table provides the API gravity of a petroleum product at observed temperatures and API gravity. This table allows specifying the commodity being measured, the reference temperature, and units of measure for density, pressure, and temperature.
ASTM1250-2004 Table 6A **NMI**	This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 60° F, using the method outlined in Chapter 11.1.6.1 of the 2004 standard. Use this table if the following conditions exist: The liquid is crude oil API Gravity @ 60 °F is known Reference Temperature is 60° F
ASTM1250-2004 Table 6B **NMI**	This table provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 60° F, using the method outlined in Chapter 11.1.6.1 of the 2004 standard. Use this table if the following conditions exist: The liquid is a refined product API Gravity @ 60 °F is known Reference Temperature is 60° F
ASTM1250-2004 Table 6C **NMI**	This table provides CTL factors for correcting volumes of petroleum liquids at observed temperatures to the volume at 60° F, using the method outlined in Chapter 11.1.6.1 of the 2004 standard. Use this table if the following conditions exist. The liquid is a refined product or crude oil Coefficient of Expansion @ 60° F is known Reference Temperature is 60° F
ASTM1250-2004 Table 6D **NMI**	This table provides CTL factors for correcting volumes of lube oils at observed temperatures to the volume at 60° F, using the method outlined in Chapter 11.1.6.1 of the 2004 standard. Use this table if the following conditions exist. The liquid is a lube oil API Gravity @ 60 °F is known Reference Temperature is 60° F

ASTM1250-2004 Table 6X	This table provides CTL factors for correcting volumes of a petroleum product at observed temperatures. This table allows specifying the commodity being measured, the coefficient of expansion, the reference temperature, and units of measure for density, pressure, and temperature.
ASTM1250-2004 Table 24A **NMI**	This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 60° F, using the method outlined in Chapter 11.1.6.1 of the 2004 standard. Use this table if the following conditions exist: The liquid is crude oil Relative Density at 60 °F is known Reference Temperature is 60° F
ASTM1250-2004 Table 24B **NMI**	This table provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 60° F, using the method outlined in Chapter 11.1.6.1 of the 2004 standard. Use this table if the following conditions exist: The liquid is a refined product Relative Density at 60° F is known Reference Temperature is 60° F
ASTM1250-2004 Table 24C **NMI**	This table provides CTL factors for correcting volumes of petroleum liquids at observed temperatures to the volume at 60° F, using the method outlined in Chapter 11.1.6.1 of the 2004 standard. Use this table if the following conditions exist. The liquid is a refined product or crude oil Coefficient of Expansion @ 60° F is known Reference Temperature is 60° F
ASTM1250-2004 Table 24D **NMI**	This table provides CTL factors for correcting volumes of lube oils at observed temperatures to the volume at 60° F, using the method outlined in Chapter 11.1.6.1 of the 2004 standard. Use this table if the following conditions exist. The liquid is a lube oil Relative Density at 60 °F is known Reference Temperature is 60° F
ASTM1250-2004 Table 24X	This table provides the CTL factors of a petroleum product at observed temperatures and Relative Density. This table allows specifying the commodity being measured, the reference temperature, and units of measure for density, pressure, and temperature
ASTM1250-2004 Table 23A **NMI**	This table provides the value of relative density at 60° F of crude oil at observed temperature and density. Use this table if the following conditions exist: The liquid is crude oil. Current Temperature and Density is available. Relative Density at 60° F is unknown Reference Temperature is 60° F
ASTM1250-2004 Table 23B **NMI**	This table provides the value of relative density at 60° F of gasolines at observed temperature and density. Use this table if the following conditions exist: The liquid is a refined product. Current Temperature and Density is available. Relative Density at 60° F is unknown Reference Temperature is 60° F
ASTM1250-	This table provides the value of relative density at 60° F of lubricating oils at observed

2004 Table 23D **NMI**	temperature and density. Use this table if the following conditions exist: The liquid is a lubricating oil. Current Temperature and Density is available. Relative Density at 60° F is unknown Reference Temperature is 60° F
ASTM1250-2004 Table 23X	This table provides the relative density of a petroleum product at observed temperature and density. This table allows specifying the commodity being measured, the reference temperature, and the units of measure for density, pressure, and temperature.
ASTM1250-2004 Table 54A **NMI**	This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is crude oil Density at 15° C is known Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 610-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 54B **NMI**	This table provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a refined product Density at 15° C is known Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 653-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 54C **NMI**	This table provides CTL factors for correcting volumes of petroleum liquids at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a refined product or crude oil Coefficient of Expansion @ 15° C is known Reference Temperature is 15° C After selecting this table, enter the Coefficient of Thermal Expansion (alpha) of the liquid at 15° C. The valid range of alpha is from 0.000486-0.001674. The alpha will be entered as 486-1674, however. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the alpha. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 54D **NMI**	This table provides CTL factors for correcting volumes of lube oils at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a lube oil Density @ 15° C is known Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at 15° C. The valid range of Density is from 800-1064 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 60A	This table provides CTL factors for correcting volumes of crude oil at observed temperatures to the volume at 20° C. Use this table if the following conditions exist. The liquid is crude oil Density at 20° C is known

NMI	Reference Temperature is 20° C After selecting this table, enter the Density of the liquid at 20° C. The valid range of Density is from 610-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 60B NMI	This table provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 20° C. Use this table if the following conditions exist. The liquid is a refined product Density at 20° C is known Reference Temperature is 20° C After selecting this table, enter the Density of the liquid at 20° C. The valid range of Density is from 653-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 60C NMI	This table provides CTL factors for correcting volumes of petroleum liquids at observed temperatures to the volume at 20° C. Use this table if the following conditions exist. The liquid is a refined product or crude oil Coefficient of Expansion @ 20° C is known Reference Temperature is 20° C After selecting this table, enter the Coefficient of Thermal Expansion (alpha) of the liquid at 20° C. The valid range of alpha is from 0.000486-0.001674. The alpha will be entered as 486-1674, however. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the alpha. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 60D NMI	This table provides CTL factors for correcting volumes of lube oils at observed temperatures to the volume at 20° C. Use this table if the following conditions exist. The liquid is a lube oil Density @ 20° C is known Reference Temperature is 20° C After selecting this table, enter the Density of the liquid at 20° C. The valid range of Density is from 800-1064 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 60X	This table provides the CTL factors of a petroleum product at observed temperatures and Density. This table allows specifying the commodity being measured, the reference temperature, and units of measure for density, pressure, and temperature
ASTM1250-2004 Table 53A NMI	This table is used to correct observed density at the observed temperature to a density at 15° C. When this table is activated, the corrected density is then automatically used in Table 54B, which provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is crude oil Observed Density is to be corrected to 15° C and used in Table 54B Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at the observed temperature. The valid range of Density is from 610-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 53B	This table is used to correct observed density at the observed temperature to a density at 15° C. When this table is activated, the corrected density is then automatically used in Table

NMI	54B, which provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a refined product Observed Density is to be corrected to 15° C and used in Table 54B Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at the observed temperature. The valid range of Density is from 653-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 53D NMI	This table is used to correct observed density at the observed temperature to a density at 15° C. When this table is activated, the corrected density is then automatically used in Table 54B, which provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 15° C. Use this table if the following conditions exist. The liquid is a lube oil Observed Density is to be corrected to 15° C and used in Table 54B Reference Temperature is 15° C After selecting this table, enter the Density of the liquid at the observed temperature. The valid range of Density is from 800-1064 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 59A NMI	This table is used to correct observed density at the observed temperature to a density at 20° C. When this table is activated, the corrected density is then automatically used in Table 54B, which provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 20° C. Use this table if the following conditions exist. The liquid is crude oil Observed Density is to be corrected to 20° C and used in Table 54B Reference Temperature is 20° C After selecting this table, enter the Density of the liquid at the observed temperature. The valid range of Density is from 610-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 59B NMI	This table is used to correct observed density at the observed temperature to a density at 20° C. When this table is activated, the corrected density is then automatically used in Table 54B, which provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 20° C. Use this table if the following conditions exist. The liquid is a refined product Observed Density is to be corrected to 20° C and used in Table 54B Reference Temperature is 20° C After selecting this table, enter the Density of the liquid at the observed temperature. The valid range of Density is from 653-1075 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 59D	This table is used to correct observed density at the observed temperature to a density at 20° C. When this table is activated, the corrected density is then automatically used in Table 54B, which provides CTL factors for correcting volumes of gasoline's at observed temperatures to the volume at 20° C. Use this table if the following conditions exist. The liquid is a lube oil Observed Density is to be corrected to 20° C and used in Table 54B Reference Temperature is 20° C

NMI	After selecting this table, enter the Density of the liquid at the observed temperature. The valid range of Density is from 800-1064 kg/m3. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
ASTM1250-2004 Table 59X	This table provides the base density of a petroleum product at observed temperatures and Density. This table allows specifying the commodity being measured, the reference temperature, and units of measure for density, pressure, and temperature
OIML6	This table is used to calculate the mass alcohol percentage at an observed temperature and a observed density. When this table is activated, the CTL factor will contain the amount of alcohol.So the net volume which is shown on each screen is the alcohol volume in the product. The liquid is a refined product Observed Density is used in Table OIML6 Observed Temperature is used After selecting this table, the density has no range checking only the temperature is allowed between -20 and + 40 degrees. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.
OIML7	This table is used to calculate the volume alcohol percentage at an observed temperature and a observed density. When this table is activated, the CTL factor will contain the amount of alcohol.So the net volume which is shown on each screen is the alcohol volume in the product. The liquid is a refined product Observed Density is used in Table OIML7 Observed Temperature is used After selecting this table, the density has no range checking only the temperature is allowed between -20 and + 40 degrees. Test temperatures can be entered on this screen that will calculate a CTL based on the test temperature and the Density. The test temperature and Calculated CTL are for informational purposes and will not be used in calculations during operations.

2. Configure Temperature Measurement

   The API tables used in MultiLoad II require the availability of an observed temperature. The observed temperature is the temperature of the liquid as it is being metered. The observed temperature can be monitored continuously with a Resistance Temperature Device (RTD) or a 4-20 mA temperature transmitter. Alternatively, a manually entered Default Temperature can be provided.

3. Configure for a Temperature Sensor

   a) Wire the temperature sensor to the internal I/O board or external FCM. Consult wiring diagrams in the Installation Guide.

   b) Perform temperature calibration.

   c) Enter the program mode at the MultiLoad II. Select the Configuration, Equipment Setup, Meters menu. Then select the preset and meter.

   d) Enable the Temperature Sensor parameter. This parameter should already be enabled if the temperature calibration step has been performed.

   e) Find the Default Temperature parameter. Configure this parameter for 999.9. Do not adjust this value unless the RTD is undergoing maintenance.

   f) Find the parameter Temp Module Type. Enter a value that represents the appropriate type of temperature sensor:

      For MultiLoad II SMP:

      1 – Internal I/O Board RTD

      3 – Internal I/O Board 4-20mA

      For MultiLoad II:

      0 – External FCM l with Opto22 RTD Module

      1 – Internal I/O Board RTD or FCM l with Toptech RTD module or FCM ll RTD

      2 – External FCM l with Opto22 4-20mA Module

      3 – Internal I/O Board 4-20mA or external FCM ll 4-20 mA.

      If the Temperature module is on a different FCM than its associated meter, add 10 to the above values.

   g) Find the Alarm High Temp parameter. (This parameter is found in Configuration/Equipment Setup/Meter menu.) Enter the temperature that represents the upper temperature limit of the API table in use.

   h) Find the Alarm Low Temp parameter. (This parameter is found in Configuration/Equipment Setup/Meter menu.) Enter the temperature that represents the lower temperature limit of the API table in use.

4. Configure for Default Temperature

   When the Temperature Sensor is undergoing maintenance, the observed temperature can be manually entered for use by the API table.

   a) Enter the program mode at the MultiLoad II. Select the Configuration, Equipment Setup, Meters menu. Then select the appropriate preset and meter.

   b) Find the parameter Temperature Sensor. Set the parameter to Disabled.

   c) Find the Default Temperature parameter. Enter the temperature that is observed at the flow meter.

   d) When the Temperature Sensor is ready to be placed back in service, re-enable the Temperature Sensor parameter and return the default temperature to 999.9.

5. Configure for Density Measurement

   For API tables that use density, a density value can be entered manually or density can be measured throughout loading. Manual density values are entered by the user when the appropriate API table is

activated. To use live density readings from a densitometer (4-20 mA) for volume correction, use the following procedure.

a) Wire the density transmitter to any available Flow Control Module (FCM). Use any available analog input port. Consult transmitter wiring diagrams in the Installation Guide.

b) Enter the program mode at the MultiLoad II. Select the Configuration, Equipment Setup, Meters menu. Then select the appropriate preset and component.

c) Find the parameter labeled Density Sensor and enable it.

d) Find the parameter labeled Density Sensor FCM# and enter a zero.

e) Find the Density @ 4 mA parameter. Enter the density that will represent the lowest density value measured by the transmitter. This value will be equal to 4 mA.

f) Find the Density @ 20 mA parameter. Enter the density that will represent the highest density value measured by the transmitter. This value will be equal to 20 mA.

g) Press the EXIT key until the Main Menu is displayed. Enter the Configuration/Equipment Setup/Component menu. Select the appropriate Preset and Component.

h) Find the Alarm Low Density parameter. Enter a density value that represents the lower density limit of the API table in use.

i) Find the Alarm High Density parameter. Enter a density value that represents the upper density limit of the API table in use.

j) Perform density calibration.

6. Configure for Relative Density Measurement

For API tables that use relative density, a relative density value can be entered manually or relative density can be measured throughout loading. Manual relative density values are entered by the user when the appropriate API table is activated. To use live relative density readings from a densitometer (4-20 mA) for volume correction, use the following procedure.

a) Wire the relative density transmitter to any available Flow Control Module (FCM). Use any available analog input port. Consult transmitter wiring diagrams in the Installation Guide.

b) Enter the program mode at the MultiLoad II. Select the Configuration, Equipment Setup, Meters menu. Then select the appropriate preset and component.

c) Find the parameter labeled Relative Density Sensor and enable it.

d) Find the parameter labeled Relative Density Sensor FCM# and enter a zero.

e) Find the Relative Density @ 4 mA parameter. Enter the relative density that will represent the lowest relative density value measured by the transmitter. This value will be equal to 4 mA.

f) Find the Relative Density @ 20 mA parameter. Enter the relative density that will represent the highest relative density value measured by the transmitter. This value will be equal to 20 mA.

g) Press the EXIT key until the Main Menu is displayed. Enter the Configuration/Equipment Setup/Component menu. Select the appropriate Preset and Component.

h) Find the Alarm Low Relative Density parameter. Enter a relative density value that represents the lower relative density limit of the API table in use.

i) Find the Alarm High Relative Density parameter. Enter a relative density value that represents the upper relative density limit of the API table in use.

j) Perform Relative Density calibration.

7. Configuring for Pressure Correction (CPL)

CPL is most commonly used for propane applications. Enter the program mode and select the Views & Inquiries menu. From the Views and Inquiries menu, select Pressure Comp. Select the preset. Select the component.

a) Select the API CPL table

Highlight this field and press Enter to scroll through the table choices. When the desired table appears, press Next to advance to the following field. Below is a list of API Table options and the conditions under which they are used.

Table 11.2.2-	This table provides CPL factors for correcting volumes of light hydrocarbons at observed pressure and temperature to the volume that exists when the liquid is at its vapor pressure. Use this table if the following conditions exist. The liquid is a NGL or LPG (propane) Relative Density at 60° F is known Reference Temperature is 60° F After selecting this table, enter the Relative Density of the liquid at 60° F. The valid range of Relative Density is from 0.350-0.637. Test temperatures and pressures can be entered on this screen that will calculate a CPL based on the test temperature, test pressure and the Relative Density. The test temperature, test pressure and Calculated CPL are for informational purposes and will not be used in calculations during operations.
Table 11.2.2M	This table provides CPL factors for correcting volumes of light hydrocarbons at observed pressure and temperature to the volume that exists when the liquid is at its vapor pressure. Use this table if the following conditions exist. The liquid is a NGL or LPG (propane) Density at 15° C is known Reference Temperature is 15° C After selecting this table, enter the Relative Density of the liquid at 15° F. The valid range of Density is 350-637 kg/m3. Test temperatures and pressures can be entered on this screen that will calculate a CPL based on the test temperature, test pressure and the Relative Density. The test temperature, test pressure and Calculated CPL are for informational purposes and will not be used in calculations during operations.

8. Configure for a Pressure Sensor
   a) Wire the pressure transmitter to the I/O board. Use any available analog input port. Consult wiring diagrams in the Installation Guide.
   b) Perform pressure calibration.
   c) Enter the program mode at the MultiLoad II. Select the Weights & Measures/Meters menu. Then select the appropriate preset and meter.
   d) Find the parameter, Pressure Sensor. This parameter should already be enabled if the pressure calibration step has been performed.
   e) Find the Default Pressure parameter. Configure this parameter for 999.9. Do not adjust this value unless the pressure transmitter is undergoing maintenance.
   f) Find the parameter Pressure @ 4mA. Enter the pressure that will represent the lowest pressure value measured by the sensor.

g) Find the parameter Pressure @ 20mA. Enter the pressure that will represent the highest pressure value measured by the sensor.

h) Press the EXIT key until the Main Menu is displayed. Enter the Configuration/Equipment Setup/Meter menu. Select the appropriate Preset and Meter.

i) Find the parameter Alarm Low Pressure. Enter the pressure that represents the lower pressure limit of the API table in use.

j) Find the parameter Alarm High Pressure. Enter the pressure that represents the highest pressure limit of the API table in use.

9. Configure for Default Pressure

When the pressure transmitter is undergoing maintenance, the observed pressure can be manually entered for use by the API table.

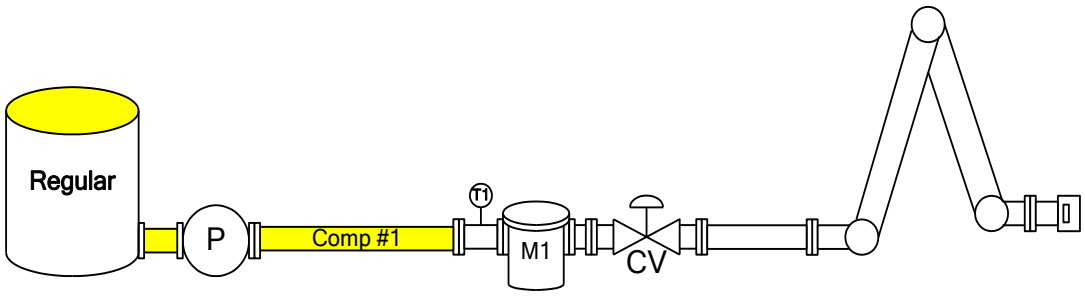
a) Enter the program mode at the MultiLoad II. Select the Weights & Measures/Meters menu. Then select the appropriate preset and meter.

b) Find the parameter, Pressure Sensor. Set the parameter to Disabled.

c) Find the Default Pressure parameter. Enter the pressure that is observed at the flow meter.

d) When the pressure transmitter is ready to be placed back in service, re-enable the pressure transmitter parameter and return the default pressure to 999.9.

9.6 MULTILOAD STRAIGHT DELIVERY (SINGLE COMPONENT) CALCULATIONS



Meter (Meter Level) values are reported as:

Gm=M1
Tm=T1
Dm=D1 OR Dr
Nm=Gm*VCFr(Tm,Dm)
Mm=Nm * Dr OR Mm=Gm * Dm

Where: Gm=Gross volume loaded for the Meter
M1=Gross volume reported by meter M1
Tm=Temperature for the Meter
T1= Volume weighted average temperature reported by probe T1
Dm=Density for the Meter
D1=Volume weighted average Density measured OR specified for meter M1
Dr=Density specified for the Regular component
Nm=Net volume loaded for the Meter
VCFr=API Correction Table for Regular
Mm = Mass loaded for the Meter

Regular product (Component Level) values are reported as:

Gr=Gm
Tr=Tm
Dr=Dr' OR Dm
Nr=Nm
Mr=Mm

Where: Gr=Gross volume loaded for the Regular component
Tr=Temperature for the Regular component
Dr=Density for the Regular component
Dr'=Density specified for the Regular component
Nr=Net volume loaded for the Regular component
Mr=Mass loaded for the Regular component

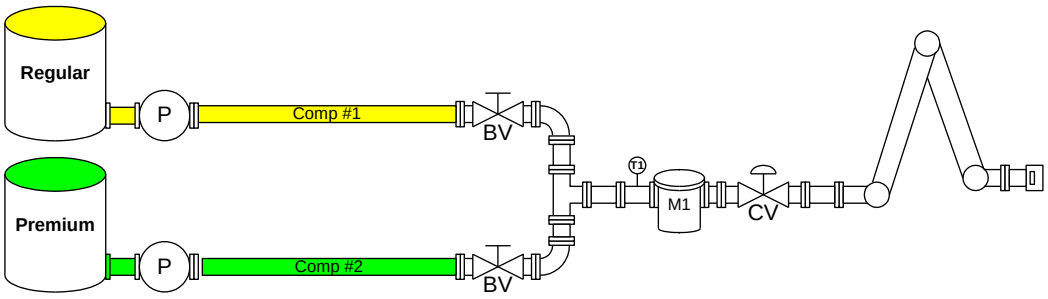
Saleable product (Preset Level) values reported as:

Gb=Gm
Tb=Tm
Db=Dm
Nb=Nm
Mb=Mm

Where: Gb=Gross volume loaded for the blend
Tb=Temperature for the blend
Db=Density for the blend
Nb=Net volume loaded for the blend
Mb=Mass loaded for the blend

Pressure and Gravity are handled in the same way as Temperature and Density.

9.7 MULTILOAD SEQUENTIAL BLENDING CALCULATIONS



Regular meter (Meter Level) values are reported as:

Grm=M1
Trm=T1
Drm=D1 OR Dr
Nrm=Grm*VCFr(Trm,Drm)
Mrm=Nrm * Dr OR Mrm=Grm * Dm

Where: Grm=Gross volume loaded for the Regular Meter
M1=Gross volume reported by meter M1 while flowing Regular
Trm=Temperature for the Regular Meter
T1= Volume weighted average temperature reported by probe T1 while flowing Regular
Drm=Density for the Regular Meter
D1=Volume weighted average Density measured while flowing Regular
OR specified for meter M1
Dr=Density specified for the Regular component
Nrm=Net volume loaded for the Regular Meter
VCFr=API Correction Table for Regular
Mrm=Mass loaded for the Regular Meter

Regular product (Component Level) values are reported as:

Gr=Grm
Tr=Trm
Dr=Dr' OR Drm
Nr=Nrm
Mr=Mrm

Where: Gr=Gross volume loaded for the Regular component
Tr=Temperature for the Regular component
Dr=Density for the Regular component
Dr'=Density specified for the Regular component
Nr=Net volume loaded for the Regular component
Mr=Mass loaded for the Regular component

Premium meter (Meter Level) values are reported as:

Gpm=M1
Tpm=T1
Dpm=D1 OR Dp
Npm=Gpm*VCFp(Tpm,Dpm)
Mpm=Npm * Dpm OR Mpm=Gpm * Dpm

Where: Gpm=Gross volume loaded for the Premium Meter
M1=Gross volume reported by meter M1 while flowing Premium
Tpm=Temperature for the Premium Meter
T1= Volume weighted average temperature reported by probe T1 while flowing Premium
Dpm=Density for the Premium Meter
D1=Volume weighted average Density measured while flowing Premium
OR specified for meter M1
Dp=Density specified for the Premium component
Npm=Net volume loaded for the Premium Meter
VCFp=API Correction Table for Premium
Mpm=Mass loaded for the Premium Meter

Premium product (Component Level) values are reported as:

Gp=Gpm
Tp=Tpm
Dp=Dp' OR Dpm
Np=Npm
Mp=Mpm

Where: Gp=Gross volume loaded for the Premium component
Tp=Temperature for the Premium component
Dp=Density for the Premium component
Dp'=Density specified for the Premium component
Np=Net volume loaded for the Premium component
Mp=Mass loaded for the Premium component

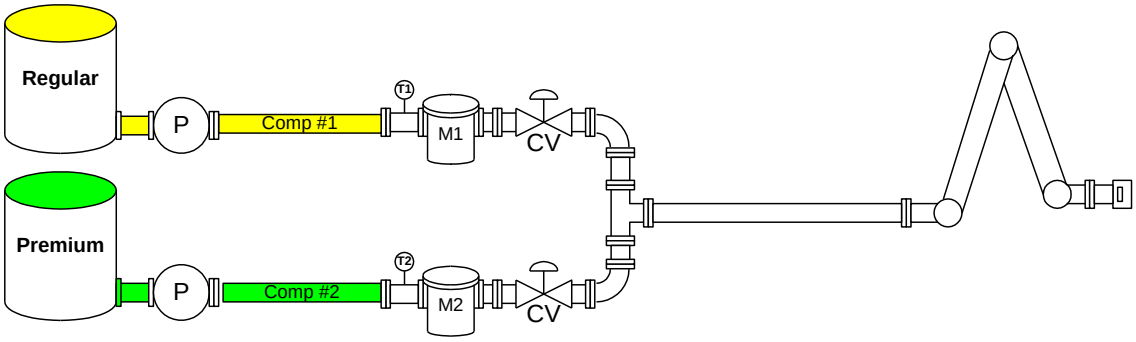
Blended product (Preset Level) values reported as:

Gb=Gr + Gp (value not to be used for trade)
Tb=((Tr*Gr) + (Tp*Gp)) / Gb (value not to be used for trade)
Db=((Dr*Gr) + (Dp*Gp)) / Gb (value not to be used for trade)
Nb=Nr + Np
Mb=Mr + Mp

Where: Gb=Gross volume loaded for the blend
Tb=Temperature for the blend
((Tr*Gr) + (Tp*Gp)) / Gb=Volume weighted temperature for the blend
Db=Density for the blend
((Dr*Gr) + (Dp*Gp)) / Gb=Volume weighted density for the blend
Nb=Net volume loaded for the blend
Mb=Mass loaded for the blend

Pressure and Gravity are handled in the same way as Temperature and Density.

9.8 MULTILOAD RATIO BLENDING CALCULATIONS



Regular meter (Meter Level) values are reported as:

Grm=M1
Trm=T1
Drm=D1 OR Dr
Nrm=Grm*VCFr(Trm,Drm)
Mrm=Nrm * Dr OR Mrm=Grm * Dm

Where:

Grm=Gross volume loaded for the Regular Meter
M1=Gross volume reported by meter M1
Trm=Temperature for the Regular Meter
T1= Volume weighted average temperature reported by probe T1
Drm=Density for the Regular Meter
D1=Volume weighted average Density measured OR specified for meter M1
Dr=Density specified for the Regular component
Nrm=Net volume loaded for the Regular Meter
VCFr=API Correction Table for Regular
Mrm=Mass loaded for the Regular Meter

Regular product (Component Level) values are reported as:

Gr=Grm
Tr=Trm
Dr=Dr' OR Drm
Nr=Nrm
Mr=Mrm

Where:

Gr=Gross volume loaded for the Regular component
Tr=Temperature for the Regular component
Dr=Density for the Regular component
Dr'=Density specified for the Regular component
Nr=Net volume loaded for the Regular component
Mr=Mass loaded for the Regular component

Premium meter (Meter Level) values are reported as:

Gpm=M2
Tpm=T2
Dpm=D2 OR Dp
Npm=Gpm*VCFp(Tpm,Dpm)
Mpm=Npm * Dpm OR Mpm=Gpm * Dpm

Where: Gpm=Gross volume loaded for the Premium Meter
M2=Gross volume reported by meter M2
Tpm=Temperature for the Premium Meter
T2= Volume weighted average temperature reported by probe T2
Dpm=Density for the Premium Meter
D2=Volume weighted average Density measured OR specified for meter M2
Dp=Density specified for the Premium component
Npm=Net volume loaded for the Premium Meter
VCFp=API Correction Table for Premium
Mpm=Mass loaded for the Premium Meter

Premium product (Component Level) values are reported as:

Gp=Gpm
Tp=Tpm
Dp=Dp' OR Dpm
Np=Npm
Mp=Mpm

Where: Gp=Gross volume loaded for the Premium component
Tp=Temperature for the Premium component
Dp=Density for the Premium component
Dp'=Density specified for the Premium component
Np=Net volume loaded for the Premium component
Mp=Mass loaded for the Premium component

Blended product (Preset Level) values reported as:

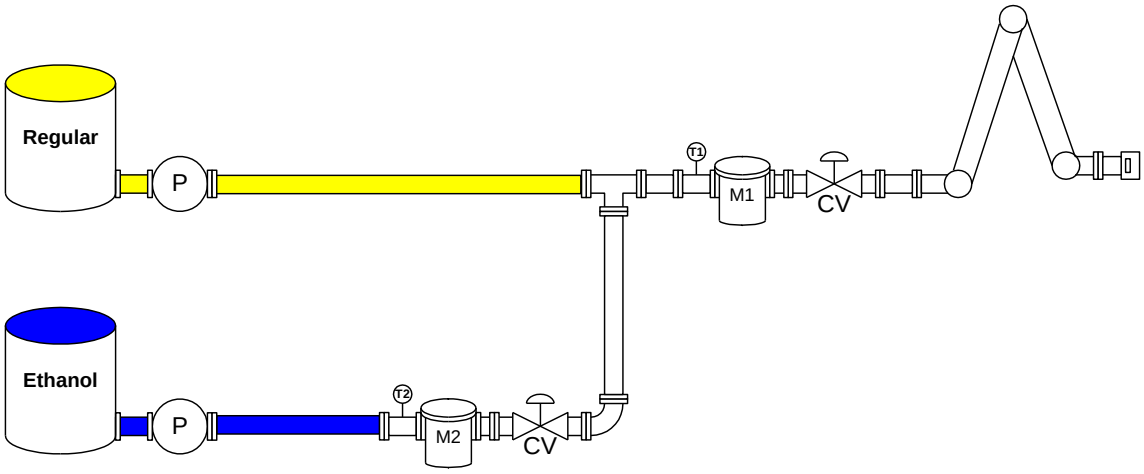
Gb=Gr + Gp (value not to be used for trade)
Tb=((Tr*Gr) + (Tp*Gp)) / Gb (value not to be used for trade)
Db=((Dr*Gr) + (Dp*Gp)) / Gb (value not to be used for trade)
Nb=Nr + Np
Mb=Mr + Mp

Where: Gb=Gross volume loaded for the blend
Tb=Temperature for the blend
((Tr*Gr) + (Tp*Gp)) / Gb=Volume weighted temperature for the blend
Db=Density for the blend
((Dr*Gr) + (Dp*Gp)) / Gb=Volume weighted density for the blend
Nb=Net volume loaded for the blend
Mb=Mass loaded for the blend

Pressure and Gravity are handled in the same way as Temperature and Density.

9.9 MULTILOAD SIDE-STREAM BLENDING CALCULATIONS

(Regular main stream, Ethanol side-stream)



Blended Meter (Meter Level) values reported as:

Gbm=M1
Tbm=T1
Dbm=D1 OR ((De * Ge) + (Dr * Gr)) / Gb
Nbm=Gbm*VCFr(Tbm,Dbm)
Mbm=Nbm * D1 OR Mbm=Gbm * Dbm

Where: Gbm=Gross volume loaded for the Blend Meter
M1=Gross volume reported by meter M1
Tbm=Temperature for the Blend Meter
T1= Volume weighted average temperature reported by probe T1
Dbm=Density for the Blend Meter
D1=Volume weighted average Density measured OR specified for meter M1
((De * Ge) + (Dr * Gr)) / Gbm=Volume weighted density for the blend
(see Preset Level Parameter Compute Blend Density)
Nbm=Net volume loaded for the Blend Meter
VCFr=API Correction Table for Regular
Mbm=Mass loaded for the Blend Meter

Blended product (Preset Level) values reported as:

Gb=Gbm
Tb=Tbm
Db=Dbm
Nb=Nbm
Mb=Mbm

Where: Gb=Gross volume loaded for the blend
Tb=Temperature for the blend
Db=Density for the blend
Nb=Net volume loaded for the blend
Mb=Mass loaded for the blend

Ethanol meter (Meter Level) values are reported as:

Gem=M2 (value not to be used for trade)
Tem=T2 (value not to be used for trade)
Dem=D2 OR De
Nem=Gem*VCFe(Tem,Dem) (value not to be used for trade)
Mem=Nem * D2 OR Mem=Gem * Dem (value not to be used for trade)

Where:
Gem=Gross volume loaded for the Ethanol Meter
M2=Gross volume reported by meter M2
Tem=Temperature for the Ethanol Meter
T2= Volume weighted average temperature reported by probe T2
Dem=Density for the Ethanol Meter
D2=Volume weighted average Density measured OR specified for meter M2
De=Density specified for the Ethanol component
Nem=Net volume loaded for the Ethanol Meter
VCFe=API Correction Table for Ethanol
Mem=Mass loaded for the Ethanol Meter

Ethanol product (Component Level) values are reported as:

Ge=Gem (value not to be used for trade)
Te=Tem (value not to be used for trade)
De=De' OR Dem
Ne=Nem (value not to be used for trade)
Me=Mem (value not to be used for trade)

Where:
Ge=Gross volume loaded for the Ethanol component
Te=Temperature for the Ethanol component
De=Density for the Ethanol component
De'=Density specified for the Ethanol component
Ne=Net volume loaded for the Ethanol component
Me=Mass loaded for the Ethanol component

Regular product (Component Level) values are reported as:

Gr=Gbm-Ge (value not to be used for trade)
Tr=((Tbm * Gbm) – (Te * Ge)) / Gr (value not to be used for trade)
Dr=Dr' OR
Dr= ((Dbm * Gbm) – (De * Ge)) / Gr (value not to be used for trade)
Nr=Nbm-Ne (value not to be used for trade)
Mr=Mbm-Me (value not to be used for trade)

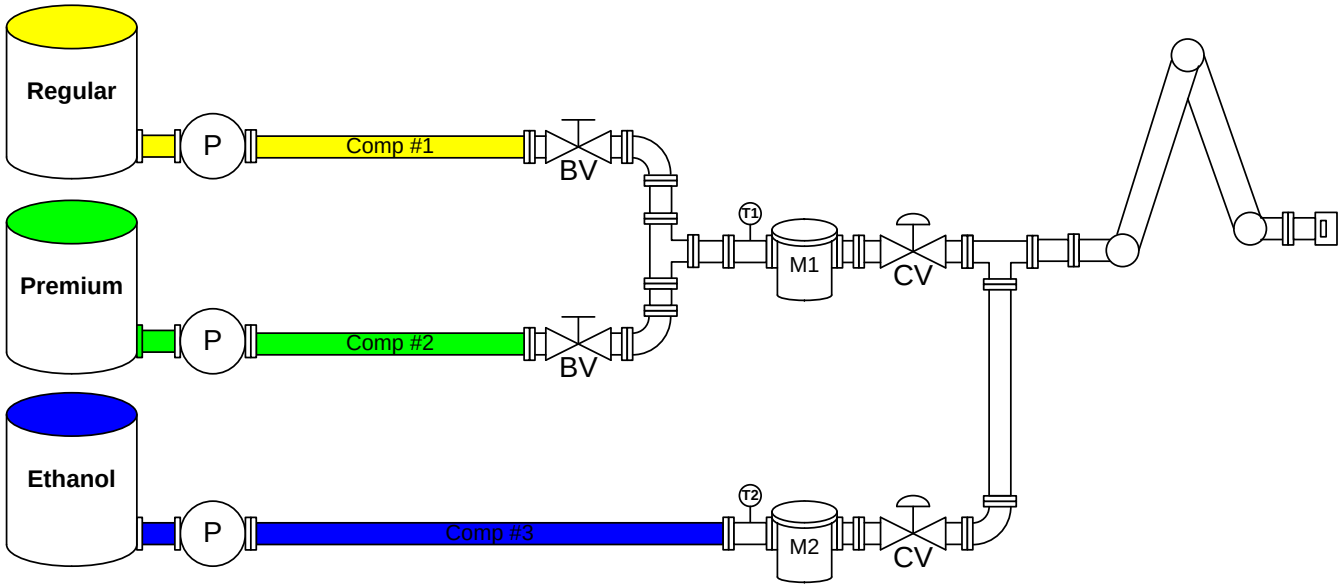
Where:
Gr=Gross volume loaded for the Regular component
Gbm-Ge=Gross volume loaded difference between Blend and Ethanol
Tr=Temperature for the Regular component
((Tbm * Gbm) – (Te * Ge)) / Gr=Back calculated average temperature for the Regular component
Dr=Density for the Regular component
Dr'=Density specified for the Regular component
((Dbm * Gbm) – (De * Ge)) / Gr=Back calculated average density for the Regular component
(see Preset Level Parameter Compute Blend Density)
Nr=Net volume loaded for the Regular component
Nbm-Ne=Net volume difference between the Blend Net Volume and Ethanol Net Volume

Mr=Mass loaded for the Regular component
Mbm-Me=Mass difference between the Blend Mass and Ethanol Mass

Pressure and Gravity are handled in the same way as Temperature and Density.

9.10 MULTILOAD SEQUENTIAL WITH RATIO BLENDING CALCULATIONS

(Regular/Premium sequential main streams, Ethanol ratio blended)



Regular meter (Meter Level) values are reported as:

Grm=M1
Trm=T1
Drm=D1 OR Dr
Nrm=Grm*VCFr(Trm,Drm)
Mrm=Nrm * Drm OR Mrm=Grm * D1

Where:

Grm=Gross volume loaded for the Regular Meter
M1=Gross volume reported by meter M1 while flowing Regular
Trm=Temperature for the Regular Meter
T1= Volume weighted average temperature reported by probe T1 while flowing Regular
Drm=Density for the Regular Meter
D1=Volume weighted average Density measured while flowing Regular
OR specified for meter M1
Dr=Density specified for the Regular component
Nrm=Net volume loaded for the Regular Meter
VCFr=API Correction Table for Regular
Mrm=Mass loaded for the Regular Meter

Regular product (Component Level) values are reported as:

Gr=Grm
Tr=Trm
Dr=Dr' OR Drm
Nr=Nrm
Mr=Mrm

Where: Gr=Gross volume loaded for the Regular component
Tr=Temperature for the Regular component
Dr=Density for the Regular component
Dr'=Density specified for the Regular component
Nr=Net volume loaded for the Regular component
Mr=Mass loaded for the Regular component

Premium meter (Meter Level) values are reported as:

Gpm=M1
Tpm=T1
Dpm=D1 OR Dp
Npm=Gpm*VCFp(Tpm,Dpm)
Mpm=Npm * Dpm OR Mpm=Gpm * D1

Where: Gpm=Gross volume loaded for the Premium Meter
M1=Gross volume reported by meter M1 while flowing Premium
Tpm=Temperature for the Premium Meter
T1= Volume weighted average temperature reported by probe T1 while flowing Premium
Dpm=Density for the Premium Meter
D1=Volume weighted average Density measured while flowing Premium
OR specified for meter M1
Dp=Density specified for the Premium component
Npm=Net volume loaded for the Premium Meter
VCFp=API Correction Table for Premium
Mpm=Mass loaded for the Premium Meter

Premium product (Component Level) values are reported as:

Gp=Gpm
Tp=Tpm
Dp=Dp' OR Dpm
Np=Npm
Mp=Mpm

Where: Gp=Gross volume loaded for the Premium component
Tp=Temperature for the Premium component
Dp=Density for the Premium component
Dp'=Density specified for the Premium component
Np=Net volume loaded for the Premium component
Mp=Mass loaded for the Premium component

Ethanol meter (Meter Level) values are reported as:

Gem=M2
Tem=T2
Dem=D2 OR De
Nem=Gem*VCFe(Tem,Dem)
Mem=Nem * Dem OR Mem=Gem * D2

Where: Gem=Gross volume loaded for the Ethanol Meter
M2=Gross volume reported by meter M2
Tem=Temperature for the Ethanol Meter
T2= Volume weighted average temperature reported by probe T2
Dem=Density for the Ethanol Meter
D2=Volume weighted average Density measured OR specified for meter M2
De=Density specified for the Ethanol component
Nem=Net volume loaded for the Ethanol Meter
VCFe=API Correction Table for Ethanol
Mem=Mass loaded for the Ethanol Meter

Ethanol product (Component Level) values are reported as:

Ge=Gem
Te=Tem
De=De' OR Dem
Ne=Nem
Me=Mem

Where: Ge=Gross volume loaded for the Ethanol component
Te=Temperature for the Ethanol component
De=Density for the Ethanol component
De'=Density specified for the Ethanol component
Ne=Net volume loaded for the Ethanol component
Me=Mass loaded for the Ethanol component

Blended product (Preset Level) values reported as:

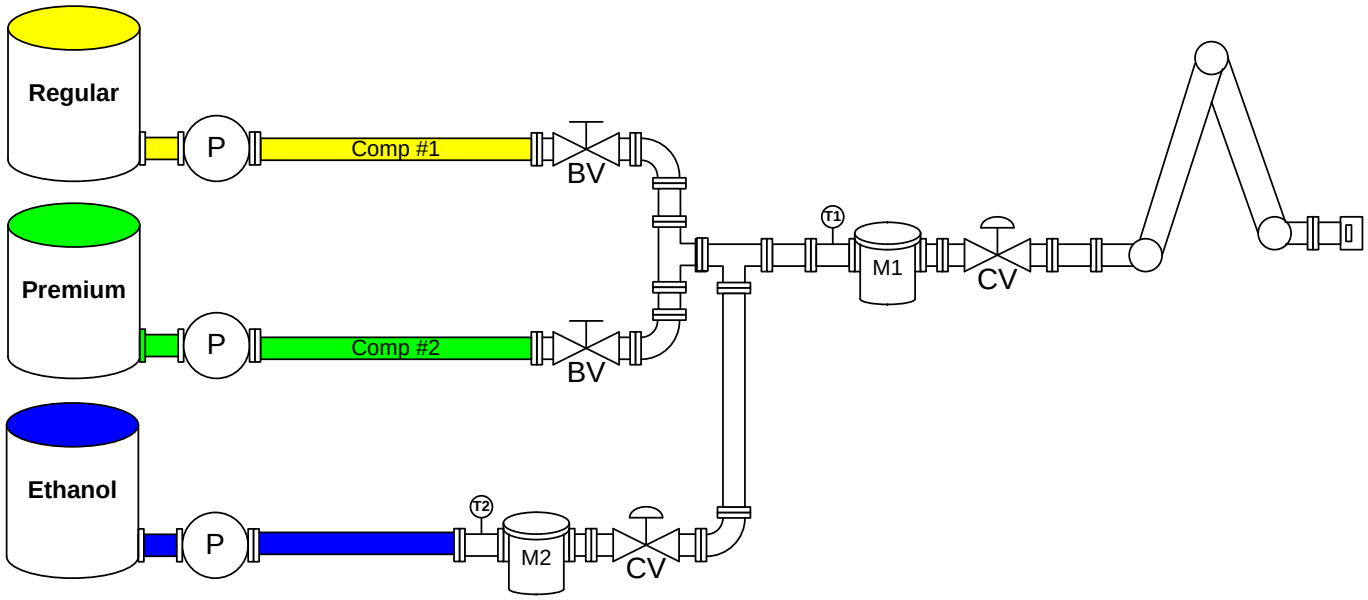
Gb=Gr + Gp + Ge (value not to be used for trade)
Tb=((Tr*Gr) + (Tp*Gp) + (Te*Ge)) / Gb (value not to be used for trade)
Db=((Dr*Gr) + (Dp*Gp) + (De*Ge)) / Gb (value not to be used for trade)
Nb=Nr + Np + Ne
Mb=Mr + Mp + Me

Where: Gb=Gross volume loaded for the blend
Tb=Temperature for the blend
((Tr*Gr) + (Tp*Gp) + (Te*Ge)) / Gb=Volume weighted temperature for the blend
Db=Density for the blend
((Dr*Gr) + (Dp*Gp) + (De*Ge)) / Gb=Volume weighted density for the blend
Nb=Net volume loaded for the blend
Mb=Mass loaded for the blend

Pressure and Gravity are handled in the same way as Temperature and Density.

9.11 MULTILOAD SEQUENTIAL WITH SIDE-STREAM BLENDING CALCULATIONS

(Regular/Premium sequential main streams, Ethanol side-stream)



Regular/Ethanol meter (Meter Level) values are reported as:

Grem=M1
Trem=T1
Drem=D1 OR ((Dr * (Grem - Ge)) + (De * Ge)) / Grem
Nrem=Grem*VCFr(Trem,Drem)
Mrem=Nrem * Drem OR Mrem=Grem * D1

Where:

Grem=Gross volume loaded for the Regular/Ethanol Meter
M1=Gross volume reported by meter M1 while flowing Regular/Ethanol
Trem=Temperature for the Regular/Ethanol Meter
T1= Volume weighted average temperature reported by probe T1 while flowing Regular/Ethanol
Drem=Density for the Regular/Ethanol Meter
D1=Volume weighted average Density measured while flowing Regular/Ethanol
OR specified for meter M1
((Dr * (Grem - Ge)) + (De * Ge)) / Grem=Volume weighted average density for Regular/Ethanol
(see Preset Level Parameter Compute Blend Density)
Dr=Density specified for the Regular component
De=Density specified for the Ethanol component
Nrem=Net volume loaded for the Regular/Ethanol Meter
VCFr=API Correction Table for Regular
Mrem=Mass loaded for the Regular/Ethanol Meter

Premium/Ethanol meter (Meter Level) values are reported as:

Gpem=M1
Tpem=T1
Dpem=D1 OR ((Dp * (Gpem - Ge)) + (De * Ge)) / Gpem
Npem=Gpem*VCFp(Tpem,Dpem)
Mpem=Npem * Dpem OR Mpem=Gpem * D1

Where:
Gpem=Gross volume loaded for the Premium/Ethanol Meter
M1=Gross volume reported by meter M1 while flowing Premium/Ethanol
Tpem=Temperature for the Premium/Ethanol Meter
T1= Volume weighted average temperature reported by probe T1 while flowing Premium/Ethanol
Dpem=Density for the Premium/Ethanol Meter
D1=Volume weighted average Density measured while flowing Premium/Ethanol
OR specified for meter M1
((Dp * (Gpem - Ge)) + (De * Ge)) / Gpem=Volume weighted average density for Premium/Ethanol
(see Preset Level Parameter Compute Blend Density)
Dp=Density specified for the Premium component
De=Density specified for the Ethanol component
Npem=Net volume loaded for the Premium/Ethanol Meter
VCFp=API Correction Table for Regular
Mpem=Mass loaded for the Premium/Ethanol Meter

Blended product (Preset Level) values reported as:

Gb=Grem + Gpem (value not to be used for trade)
Tb=((Trem*Grem) + (Tpem*Gpem)) / Gb (value not to be used for trade)
Db=((Drem*Grem) + (Dpem*Gpem) / Gb (value not to be used for trade)
Nb=Nrem + Npem
Mb=Mrem + Mpem

Where:
Gb=Gross volume loaded for the blend
Tb=Temperature for the blend
((Trem*Grem) + (Tpem*Gpem)) / Gb =Volume weighted temperature for the blend
Db=Density for the blend
((Drem*Grem) + (Dpem*Gpem) / Gb =Volume weighted density for the blend
Nb=Net volume loaded for the blend
Mb=Mass loaded for the blend

Ethanol meter (Meter Level) values are reported as:

Gem=M2 (value not to be used for trade)
Tem=T2 (value not to be used for trade)
Dem=D2 OR De
Nem=Gem*VCFe(Tem,Dem) (value not to be used for trade)
Mem=Nem * Dem OR Mem=Gem * D1 (value not to be used for trade)

Where:
Gem=Gross volume loaded for the Ethanol Meter
M2=Gross volume reported by meter M2
Tem=Temperature for the Ethanol Meter
T2= Volume weighted average temperature reported by probe T2
Dem=Density for the Ethanol Meter
D2=Volume weighted average Density measured OR specified for meter M2
De=Density specified for the Ethanol component
Nem=Net volume loaded for Ethanol Meter
VCFe=API Correction Table for Ethanol
Mem=Mass loaded for Ethanol Meter

Ethanol product (Component Level) values are reported as:

Ge=Gem (value not to be used for trade)
Te=Tem (value not to be used for trade)
De=De' OR Dem
Ne=Nem (value not to be used for trade)
Me=Mem (value not to be used for trade)

Where:
Ge=Gross volume loaded for the Ethanol component
Te=Temperature for the Ethanol component
De=Density for the Ethanol component
De'=Density specified for the Ethanol component
Ne=Net volume loaded for the Ethanol component
Me=Mass loaded for the Ethanol component

Regular product (Component Level) values are reported as:

Gr=Grem-Ger	(value not to be used for trade)
Tr=((Trem * Grem) – (Ter * Ger)) / Gr	(value not to be used for trade)
Dr=Dr' OR	
Dr= ((Drem * Grem) – (Der * Ger)) / Gr	(value not to be used for trade)
Nr=Nrem-Ner	(value not to be used for trade)
Mr=Mrem-Mer	(value not to be used for trade)

Where: Gr=Gross volume loaded for the Regular component

Ger=Gross volume loaded for the Ethanol component while flowing Regular/Ethanol

Tr=Temperature for the Regular component

Ter= Volume weighted average temperature for the Ethanol component while flowing Regular/Ethanol

((Trem * Grem) – (Ter * Ger)) / Gr=Back calculated average temperature for the Regular component

Dr=Density for the Regular component

Dr'=Density specified for the Regular component

Der=Volume weighted average Density for the Ethanol component while flowing Regular/Ethanol

((Drem * Grem) – (Der * Ger)) / Gr=Back calculated average density for the Regular component

(see Preset Level Parameter Compute Blend Density)

Nr=Net volume loaded for the Regular component

Ner=Net volume loaded for the Ethanol component while flowing Regular/Ethanol

Mr=Mass loaded for the Regular component

Mer=Mass loaded for the Ethanol component while flowing Regular/Ethanol

Premium product (Component Level) values are reported as:

Gp=Gpem-Gep	(value not to be used for trade)
Tp=((Tpem * Gpem) – (Tep * Gep)) / Gp	(value not to be used for trade)
Dp=Dp' OR	
Dp= ((Dpem * Gpem) – (Dep * Gep)) / Gp	(value not to be used for trade)
Np=Npem-Nep	(value not to be used for trade)
Mp=Mpem-Mep	(value not to be used for trade)

Where: Gp=Gross volume loaded for the Premium component

Gep=Gross volume loaded for the Ethanol component while flowing Premium/Ethanol

Tp=Temperature for the Premium component

Tep= Volume weighted average temperature for the Ethanol component while flowing Premium/Ethanol

((Tpem * Gpem) – (Tep * Gep)) / Gp=Back calculated average temperature for the Premium component

Dp=Density for the Premium component

Dp'=Density specified for the Premium component

Dep=Volume weighted average Density for the Ethanol component while flowing Premium/Ethanol

((Dpem * Gpem) – (Dep * Gep)) / Gp=Back calculated average density for the Premium component

(see Preset Level Parameter Compute Blend Density)

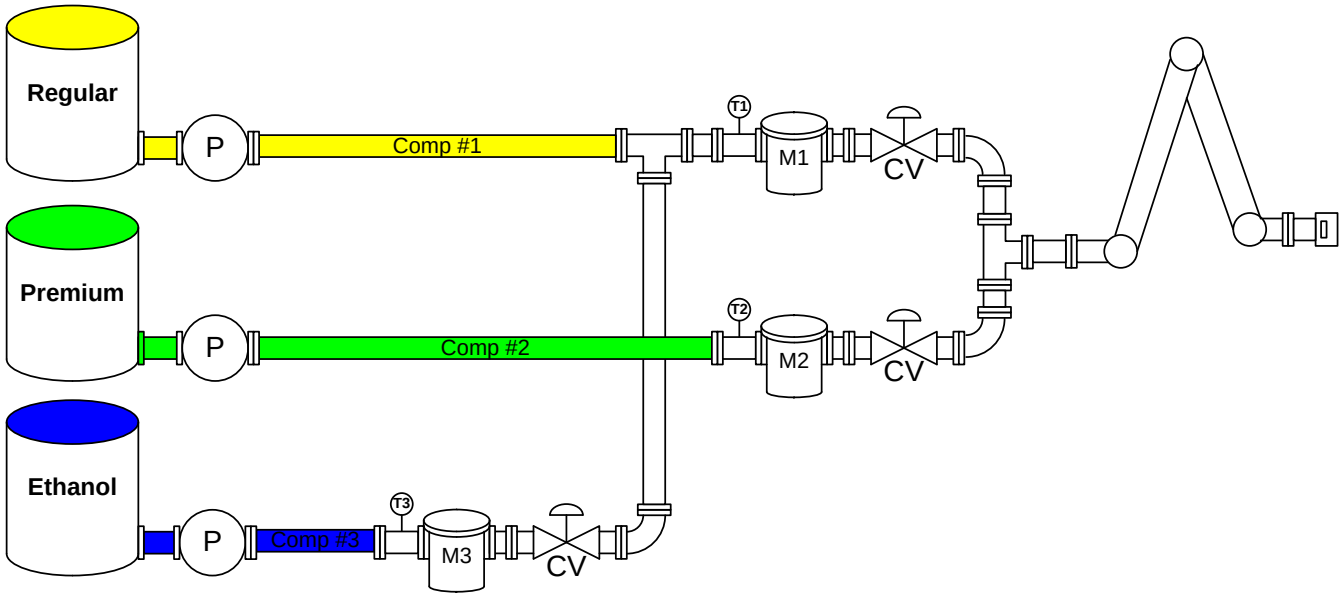
Np=Net volume loaded for the Premium component

Nep=Net volume loaded for the Ethanol component while flowing Premium/Ethanol
Mp=Mass loaded for the Premium component
Mep=Mass loaded for the Ethanol component while flowing Premium/Ethanol

Pressure and Gravity are handled in the same way as Temperature and Density.

9.12 MULTILOAD RATIO WITH SIDE-STREAM BLENDING CALCULATIONS

(Regular/Premium ratio main streams, Ethanol side-stream on Regular)



Regular/Ethanol Meter (Meter Level) values reported as:

Grem=M1
Trem=T1
Drem=D1 OR ((De * Ge) + (Dr * Gr)) / Gb
Nrem=Grem*VCFr(Trem,Drem)
Mrem=Nrem * Drem OR Mrem=Grem * D1

Where:

Grem=Gross volume loaded for the Regular/Ethanol Meter
M1=Gross volume reported by meter M1
Trem=Temperature for the Regular/Ethanol Meter
T1= Volume weighted average temperature reported by probe T1
Drem=Density for the Regular/Ethanol Meter
D1=Volume weighted average Density measured OR specified for meter M1
((De * Ge) + (Dr * Gr)) / Grem=Volume weighted density for the Regular/Ethanol blend *(see Preset Level Parameter Compute Blend Density)*
Nrem=Net volume loaded for the Regular/Ethanol Meter
VCFr=API Correction Table for Regular
Mrem=Mass loaded for the Regular/Ethanol Meter

Premium meter (Meter Level) values are reported as:

Gpm=M2
Tpm=T2
Dpm=D2 OR Dp
Npm=Gpm*VCFp(Tpm,Dpm)
Mpm=Npm * Dpm OR Mpm=Gpm * D2

Where: Gpm=Gross volume loaded for the Premium Meter
M2=Gross volume reported by meter M2
Tpm=Temperature for the Premium Meter
T2= Volume weighted average temperature reported by probe T2
Dpm=Density for the Premium Meter
D2=Volume weighted average Density measured OR specified for meter M2
Dp=Density specified for the Premium component
Npm=Net volume loaded for the Premium Meter
VCFp=API Correction Table for Premium
Mpm=Mass loaded for the Premium Meter

Blended product (Preset Level) values reported as:

Gb=Grem + Gpm (value not to be used for trade)
Tb=((Trem*Grem) + (Tpm*Gpm)) / Gb (value not to be used for trade)
Db=((Drem*Grem) + (Dpm*Gpm)) / Gb (value not to be used for trade)
Nb=Nrem + Npem
Mb=Mrem + Mpem

Where: Gb=Gross volume loaded for the blend
Tb=Temperature for the blend
((Trem*Grem) + (Tpm*Gpm)) / Gb=Volume weighted temperature for the blend
Db=Density for the blend
((Drem*Grem) + (Dpm*Gpm)) / Gb=Volume weighted density for the blend
Nb=Net volume loaded for the blend
Mb=Mass loaded for the blend

Ethanol meter (Meter Level) values are reported as:

Gem=M3	(value not to be used for trade)
Tem=T3	(value not to be used for trade)
Dem=D3 OR De	
Nem=Gem*VCFe(Tem,Dem)	(value not to be used for trade)
Mem=Nem * Dem OR Mem=Gem * D2	(value not to be used for trade)

Where:

Gem=Gross volume loaded for the Ethanol Meter
M3=Gross volume reported by meter M3
Tem=Temperature for the Ethanol Meter
T3= Volume weighted average temperature reported by probe T3
Dem=Density for the Ethanol Meter
D3=Volume weighted average Density measured OR specified for meter M3
De=Density specified for the Ethanol component
Nem=Net volume loaded for the Ethanol Meter
VCFe=API Correction Table for Ethanol
Mem=Mass loaded for the Ethanol Meter

Ethanol product (Component Level) values are reported as:

Ge=Gem	(value not to be used for trade)
Te=Tem	(value not to be used for trade)
De=De' OR Dem	
Ne=Nem	(value not to be used for trade)
Me=Mem	(value not to be used for trade)

Where:

Ge=Gross volume loaded for the Ethanol component
Te=Temperature for the Ethanol component
De=Density for the Ethanol component
De'=Density specified for the Ethanol component
Ne=Net volume loaded for the Ethanol component
Me=Mass loaded for the Ethanol component

Regular product (Component Level) values are reported as:

Gr=Grem-Ge	(value not to be used for trade)
Tr=((Trem * Grem) – (Te * Ge)) / Gr	(value not to be used for trade)
Dr=Dr' OR	
Dr= ((Drem * Grem) – (De * Ge)) / Gr	(value not to be used for trade)
Nr=Nrem-Ne	(value not to be used for trade)
Mr=Mrem-Me	(value not to be used for trade)

Where: Gr=Gross volume loaded for the Regular component

Grem-Ge=Gross volume loaded difference between Blend and Ethanol

Tr=Temperature for the Regular component

((Trem * Grem) – (Te * Ge)) / Gr=Back calculated average temperature for the Regular component

Dr=Density for the Regular component

Dr'=Density specified for the Regular component

((Drem * Grem) – (De * Ge)) / Gr=Back calculated average density for the Regular component *(see Preset Level Parameter Compute Blend Density)*

Nr=Net volume loaded for the Regular component

Nrem-Ne=Net volume difference between the Blend Net Volume and Ethanol Net Volume

Mr=Mass loaded for the Regular component

Mrem-Me=Mass difference between the Blend Mass and Ethanol Mass

Premium product (Component Level) values are reported as:

Gp=Gpm

Tp=Tpm

Dp=Dp' OR Dpm

Np=Npm

Mp=Mpm

Where: Gp=Gross volume loaded for the Premium component

Tp=Temperature for the Premium component

Dp=Density for the Premium component

Dp'=Density specified for the Premium component

Np=Net volume loaded for the Premium component

Mp=Mass loaded for the Premium component

Pressure and Gravity are handled in the same way as Temperature and Density.

9.13 TEMPERATURE CALIBRATION FOR METERS

Use the Temperature screen to calibrate temperature for a meter.

1. From the Views amd Inquiries Menu, choose **Temperature**. After selecting the preset and meter, the Temperature screen displays.

```
        PRE #1 MTR #1 TEMPERATURE

   Temperature Unadjusted:      +42.27C
[1]Temperature Offset:           +0.00C
[2]Temperature Adjusted:        +42.27C
               Status Ok

            Next  Prev  Exit
```

2. If the observed temperature is different from the unadjusted temperature displayed, there are two options:
   - Press **1** and key in the observed offset (that is, the difference between the Temp Unadjusted and Temp Adjusted).
   - Or, press **2** and key in the observed temperature in the Temp Adjusted field, in which case the Temp Offset will automatically be calculated and displayed.

```
        PRE #1 MTR #1 TEMPERATURE

   Temperature Unadjusted:      +42.27C
[1]Temperature Offset:          +      C
[2]Temperature Adjusted:        +42.27C
               Status Ok

            +/-  Enter  Exit
```

Use the +/- key to toggle between a minus (–) sign and a plus (+) sign on the offset.

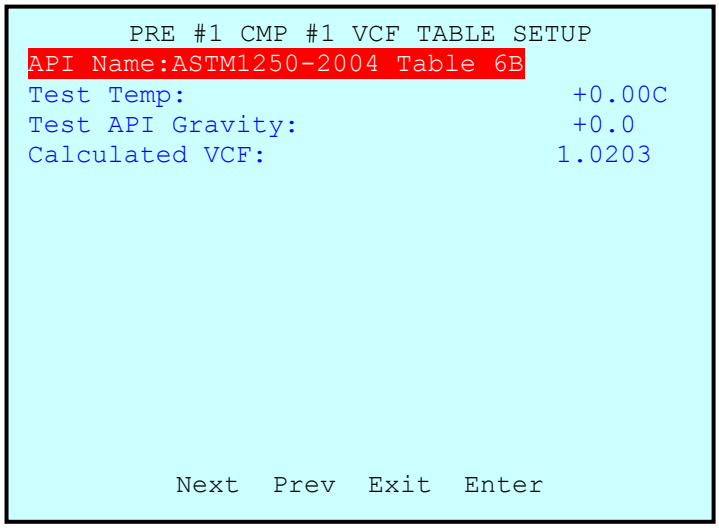
The temperature offset cannot exceed + or – 3 degrees. If you enter a value greater than 3 in this field, the value will change to 3, and the temperature will be adjusted by no more than + or – 3 degrees. Likewise, if you enter an observed temperature that exceeds the Temp Unadjusted value by 3 degrees, the offset will only change by 3 degrees.

Parameter	Description
Temp Unadjusted	Displays the Resistance Temperature Detector real-time temperature.
Temp Offset	Displays the current temperature offset value, which is the difference between the Temp Unadjusted value and the Temp Adjusted (observed temperature) value.
Temp Adjusted	Displays the observed temperature as a result of applying the temperature offset.

9.14 TEMPERATURE COMPENSATION AND VCF CALCULATOR

Use the Temp(erature) Comp(ensation) function to configure an API table for volume Correction for Temperature of Liquid (CTL) and for volume Correction for Pressure of Liquid (CPL). This screen will also permit the entry of a test temperature to calculate a CTL based on various temperatures. When a test temperature is entered, a VCF will be calculated and displayed. The test temperature has no influence on normal operations.

1. From the Views & Inquiries Menu, choose **Temp Comp**. After selecting the preset and component, the VCF Table Setup screen displays:


PRE #1 CMP #1 VCF TABLE SETUP
API Name:ASTM1250-2004 Table 6B
Test Temp: +0.00C
Test API Gravity: +0.0
Calculated VCF: 1.0203
Next Prev Exit Enter

2. Highlight the API VCF Table Name row and press **ENTER**.
3. Press the **Next** or **Previous** key to scroll through the API table choices. Press **ENTER** to select the desired table. Two parameter fields are added to the screen: one is API Test Temp; the other depends on the API table selected.
4. Enter a test temperature value in the Test Temp field. This value is used to calculate a VCF on the bottom of the screen for information purposes. The value entered in this field will have no effect on net calculations during normal operation. Enter a value of zero until the remaining data is entered.
5. Depending on the API table selected, the next prompt will call for either a gravity, a density or an expansion coefficient. When the user enters a value, the Calculated VCF will change accordingly. If the bottom line displays, “API Input Data Out of Range!”, it is possible that the value entered is invalid for the selected API table.
6. After a valid density, gravity or expansion coefficient has been entered, configuration for VCF is complete. At this point, various test temperatures, densities and relative densities can be entered to view what VCF would be used if the liquid’s temperature was of the same value.

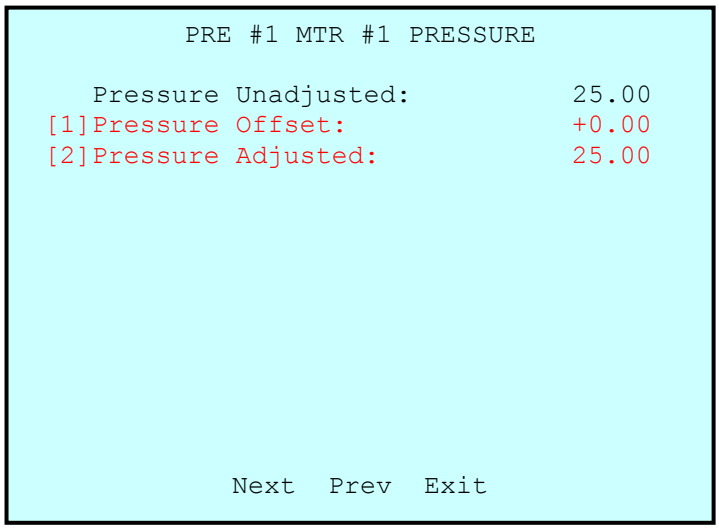
Parameter	Description
API Name	Select the desired API table to correct liquid volumes to a reference temperature. Highlight the field and press Enter to scroll through the choices.
Test Temp	Enter a test temperature in this field. The temperature that is entered here will not have any effect on actual measurement.
Test Density or Test Relative Density or Test API Gravity	Enter a test density, test relative density or test API Gravity in this field. The value that is entered here will not have any effect on actual measurement.

Parameter	Description
API Gravity/Expansion Coefficient	One of these fields will appear, depending on the API table selected. Enter the requested value in this field. The value that is entered in this field will be used to calculate VCF during operations.
Calculated VCF	The value in this field is the result of the API Test Temperature and the data in the previous field (density, gravity, or expansion coefficient). This Calculated VCF is for information only and has no affect on actual measurement.
Corrected Relative Density	This field will appear, depending on the API table selected. The value will show the corrected Relative Density.
Corrected Density	This field will appear, depending on the API table selected. The value will show the corrected Density.
Corrected Gravity	This field will appear, depending on the API table selected. The value will show the corrected Gravity.

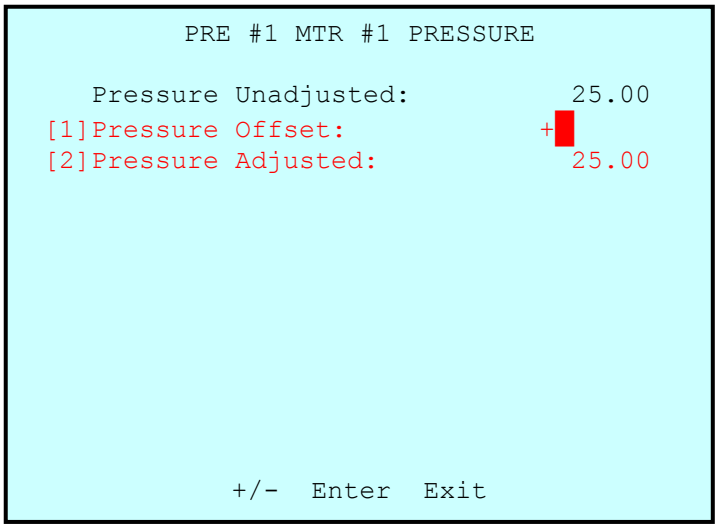
9.15 PRESSURE CALIBRATION FOR METERS

Use the Pressure screen to calibrate pressure for a meter.

1. From the Views & Inquiries Menu, choose **Pressure.**. After selecting the preset and meter, the Pressure screen displays:



2. If the observed pressure is different from the unadjusted pressure displayed, there are two options:
   - Press **1** and key in the observed offset (that is, the difference between the Pressure Unadjusted and Pressure Adjusted).
   - Or, press **2** and key in the observed pressure in the Pressure Adjusted field, in which case the Pressure Offset will automatically be calculated and displayed.



Use the +/- key to toggle between a minus (–) sign and a plus (+) sign on the offset.

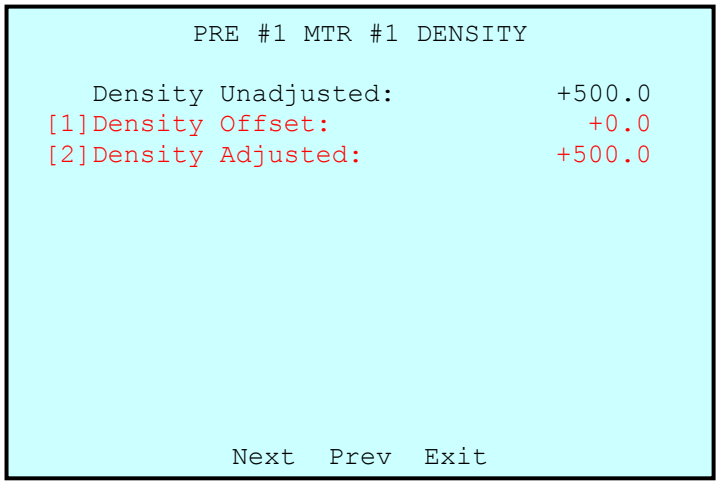
Parameter	Description
Pressure Unadjusted	Displays the real-time pressure.

Parameter	Description
Pressure Offset	Displays the pressure offset value, which is the difference between the Pressure Unadjusted value and the Pressure Adjusted (observed pressure) value.
Pressure Adjusted	Displays the observed pressure as a result of applying the pressure offset.

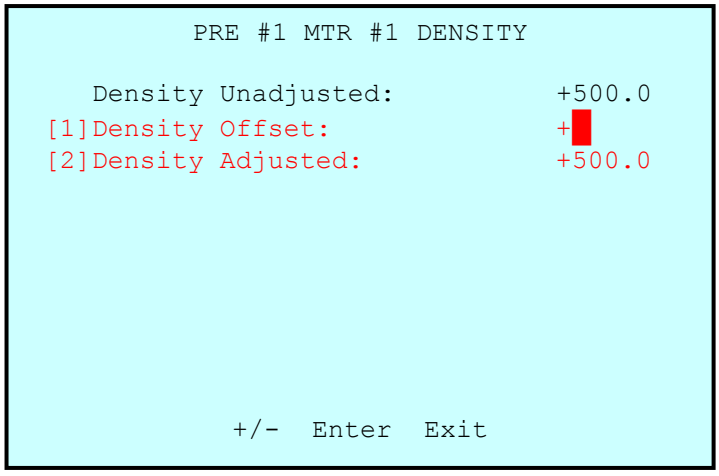
9.16 DENSITY CALIBRATION

Use the Density screen to calibrate density for a Meter.

1. From the Views & Inquiries Menu, choose **Density.** After selecting the preset and meter, the Density screen displays:



2. If the observed Density is different from the unadjusted density displayed, there are two options:
   - Press **1** and key in the observed offset (that is, the difference between the Density Unadjusted and Density Adjusted).
   - Or, press **2** and key in the observed density in the Density Adjusted field, in which case the Density Offset will automatically be calculated and displayed.



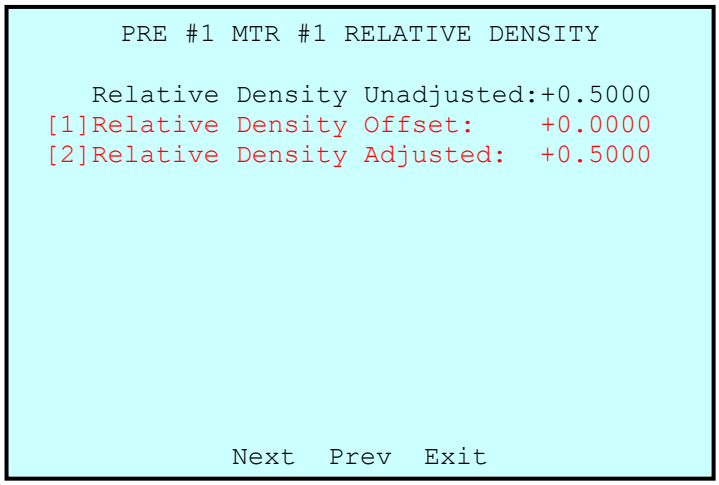
Use the +/- key to toggle between a minus (–) sign and a plus (+) sign on the offset.

Parameter	Description
Density Unadjusted	Displays the real-time density.
Density Offset	Displays the current Density offset value, which is the difference between the Density Unadjusted value and the Density Adjusted (observed density) value.
Density Adjusted	Displays the observed density as a result of applying the density offset.

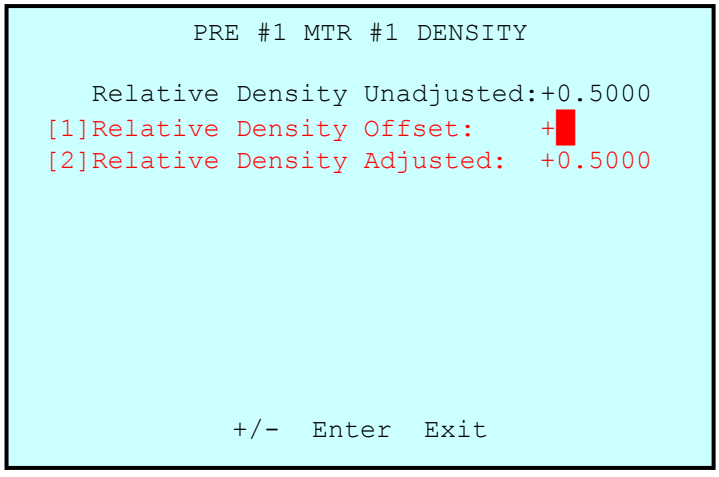
9.17 RELATIVE DENSITY CALIBRATION

Use the Relative Density screen to calibrate relative density for a Meter.

3. From the Views & Inquiries Menu, choose **Relative Density.** After selecting the preset and meter, the Relative Density screen displays:


PRE #1 MTR #1 RELATIVE DENSITY
Relative Density Unadjusted:+0.5000
[1]Relative Density Offset: +0.0000
[2]Relative Density Adjusted: +0.5000
Next Prev Exit

4. If the observed Relative Density is different from the unadjusted relative density displayed, there are two options:
   - Press **1** and key in the observed offset (that is, the difference between the Relative Density Unadjusted and Relative Density Adjusted).
   - Or, press **2** and key in the observed density in the Relative Density Adjusted field, in which case the Relative Density Offset will automatically be calculated and displayed.



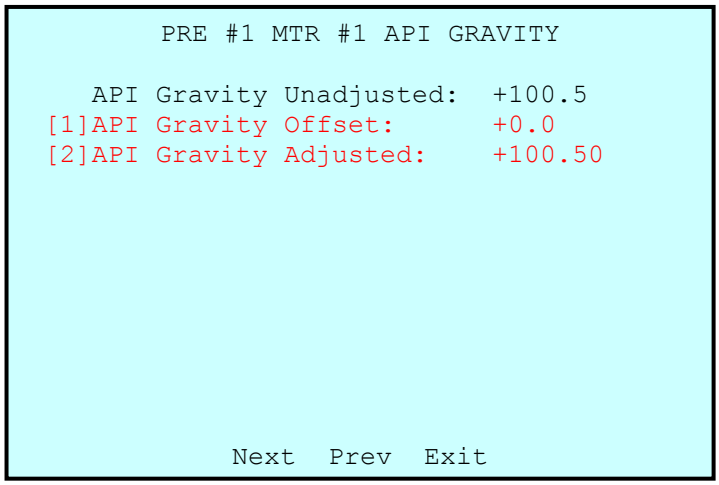
Use the +/- key to toggle between a minus (–) sign and a plus (+) sign on the offset.

Parameter	Description
Relative Density Unadjusted	Displays the real-time relative density.
Relative Density Offset	Displays the current Relative Density offset value, which is the difference between the Relative Density Unadjusted value and the Relative Density Adjusted (observed relative density) value.
Relative Density Adjusted	Displays the observed relative density as a result of applying the relative density offset.

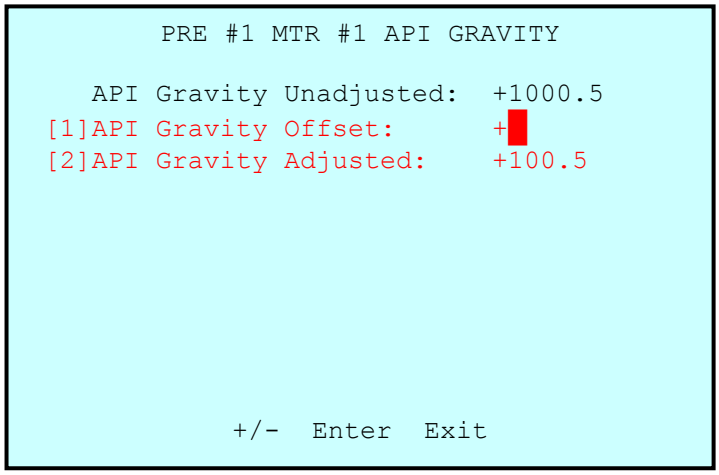
9.18 API GRAVITY CALIBRATION

Use the API Gravity screen to calibrate API Gravity for a Meter.

5. From the Views & Inquiries Menu, choose **API Gravity.** After selecting the preset and meter, the API Gravity screen displays:



6. If the observed API Gravity is different from the unadjusted API Gravity displayed, there are two options:
   - Press **1** and key in the observed offset (that is, the difference between the API Gravity Unadjusted and API Gravity Adjusted).
   - Or, press **2** and key in the observed gravity in the API Gravity Adjusted field, in which case the API Gravity Offset will automatically be calculated and displayed.



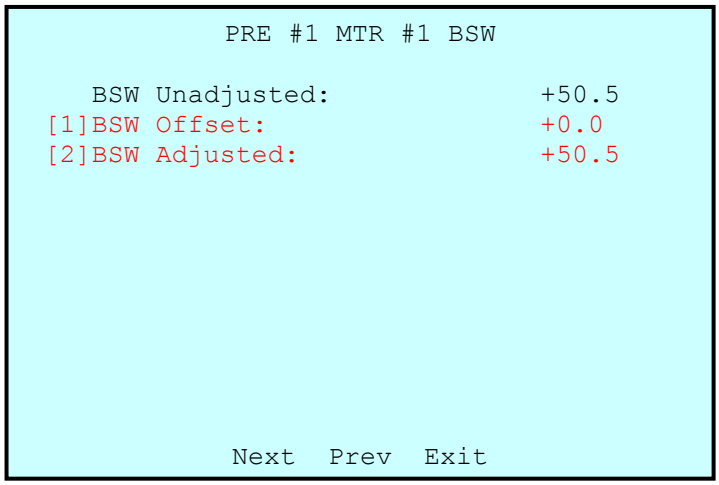
Use the +/- key to toggle between a minus (–) sign and a plus (+) sign on the offset.

Parameter	Description
API GravityUnadjusted	Displays the real-time relative density.
API Gravity Offset	Displays the current API Gravity offset value, which is the difference between the API Gravity Unadjusted value and the API Gravity Adjusted (observed relative density) value.
API Gravity Adjusted	Displays the observed API Gravity as a result of applying the API Gravity offset.

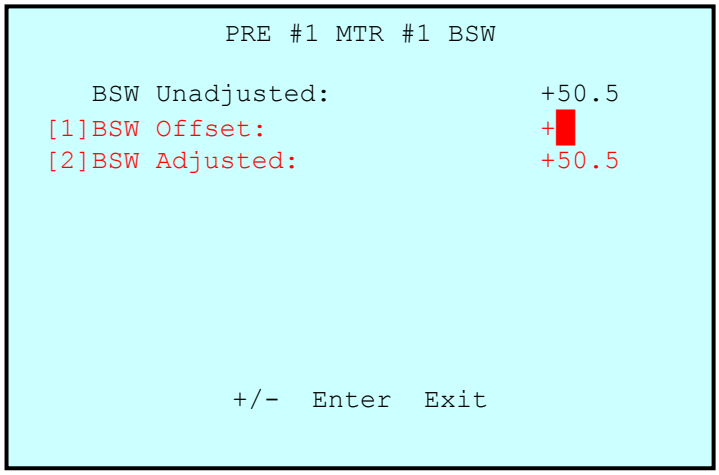
9.19 BSW CALIBRATION

Use the BSW screen to calibrate relative density for a Meter.

7. From the Views & Inquiries Menu, choose **BSW.** After selecting the preset and meter, the BSW screen displays:



8. If the observed BSW is different from the unadjusted BSW displayed, there are two options:
   - Press **1** and key in the observed offset (that is, the difference between the BSW Unadjusted and BSW Adjusted).
   - Or, press **2** and key in the observed BSW in the BSW Adjusted field, in which case the BSW Offset will automatically be calculated and displayed.



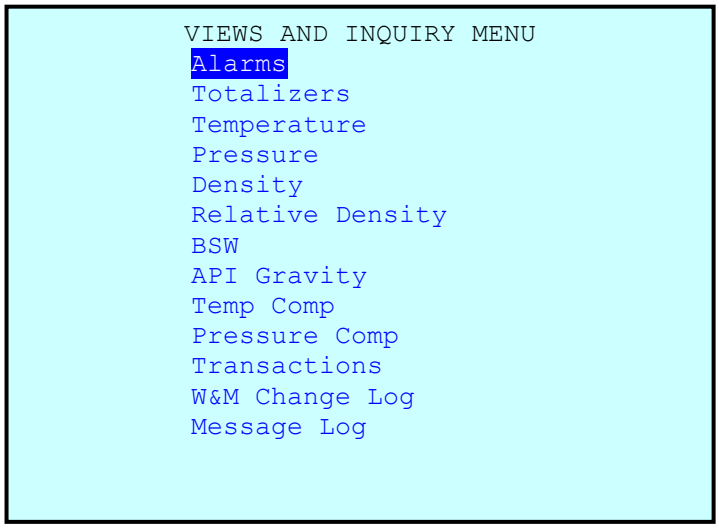
Use the +/- key to toggle between a minus (–) sign and a plus (+) sign on the offset.

Parameter	Description
BSW Unadjusted	Displays the real-time BSW.
BSW Offset	Displays the current BSW offset value, which is the difference between the BSW Unadjusted value and the BSW Adjusted (observed BSW) value.
BSW Adjusted	Displays the observed BSW as a result of applying the BSW offset.

CHAPTER 10 VIEWS AND INQUIRIES

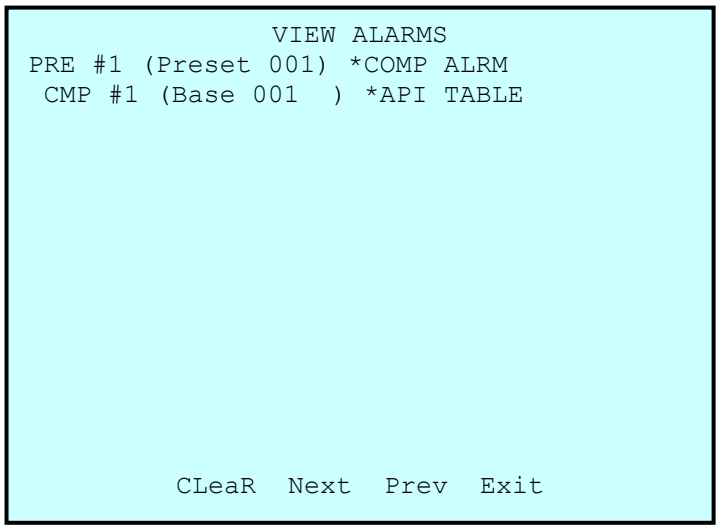
10.1 OVERVIEW

The MultiLoad II provides inquiry functions available from the VIEWS AND INQUIRY MENU, shown below:



10.2 VIEWING ALARMS

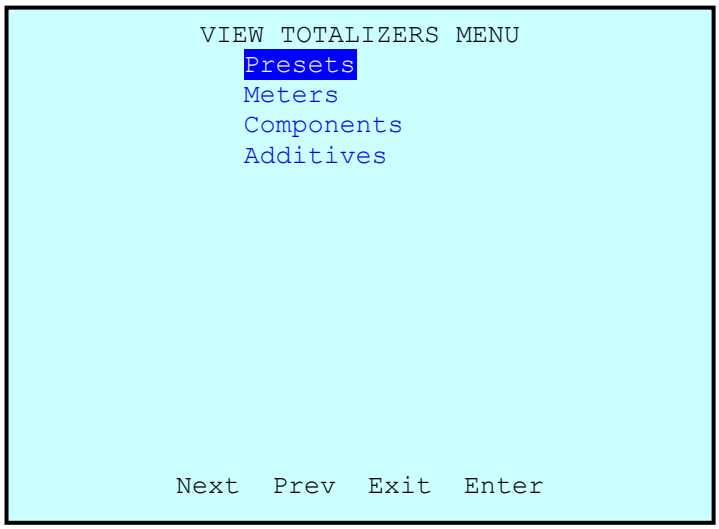
From the Views and Inquiry menu, select **Alarms**.
The View Alarms screen displays all current alarms.



The listed alarms that are indented one space are associated with the preset listed above them.
If the Alarm message is longer than the display screen allows, the message will wrap to the next line.
To clear all active alarms, press the **CLR** key. However, certain alarms, such as RTD ERROR, will not clear until the condition has been corrected.

10.3 VIEWING TOTALIZERS

From the Views and Inquiry Menu select Totalizers. The View Totalizers Menu displays:
It is also possible to go straight to this view screen via code 4448 combined with NEXT.



10.3.1 VIEWING PRESET TOTALIZERS

From the View Totalizers Menu, select Presets. After selecting the preset, the Preset Totalizers screen displays:

```
      PRE #1 (Preset 001) TOTALIZERS

       Total Gross:000000631 (000000631)
       Total Net  :000000631 (000000631)
       Total Mass :000000631 (000000631)
  Authorized Gross:000000631 (000000631)
  Authorized Net  :000000631 (000000631)
  Authorized Mass :000000631 (000000631)
Unauthorized Gross:000000000 (000000000)
Unauthorized Net  :000000000 (000000000)
Unauthorized Mass :000000000 (000000000)
```

```
      PRE #1 (Preset 001) TOTALIZERS

       Total Gross:0000006.31 0000006.31
       Total Net  :0000006.31 0000006.31
       Total Mass :0000006.31 0000006.31
  Authorized Gross:0000006.31 0000006.31
  Authorized Net  :0000006.31 0000006.31
  Authorized Mass :0000006.31 0000006.31
Unauthorized Gross:0000000.00 0000000.00
Unauthorized Net  :0000000.00 0000000.00
Unauthorized Mass :0000000.00 0000000.00
```

Parameter Descriptions

Total Gross	Total gross volume through the preset (load arm).
Total Net	Total net volume through the preset (load arm).
Total Mass	Total mass through the preset(load arm).
Authorized Gross	Total authorized gross volume through the preset (load arm).
Authorized Net	Total authorized net volume through the preset (load arm).
Authorized Mass	Total authorized mass through the preset (load arm).
Unauthorized Gross	Total unauthorized gross volume through the preset (load arm).
Unauthorized Net	Total unauthorized net volume through the preset (load arm).
Unauthorized Mass	Total unauthorized mass through the preset (load arm).

Notes:

- Volume numbers displayed are whole numbers or with 1/100 resolution depending on the current setting of the “Use Hundredths” RCU W&M Parameter.
- The numbers on the left indicate volumes in non-resettable totalizers.
- The numbers on the right indicate volumes in resettable totalizers.

Use the **CLR** key to zero out the resettable totalizers.

10.3.2 VIEWING METER TOTALIZERS

From the View Totalizers Menu, select Meters. After selecting the preset and meter, the Meter Totalizers screen displays:

```
         PRE #1 MTR #1 TOTALIZERS

       Total Gross:000000631 (000000631)
  Authorized Gross:000000631 (000000631)
Unauthorized Gross:000000000 (000000000)
 Meter Creep Gross:000000000 (000000000)
    Backflow Gross:000000000 (000000000)









          CLeaR  Next  Prev  Exit
```

```
         PRE #1 MTR #1 TOTALIZERS

       Total Gross:0000006.31 0000006.31
  Authorized Gross:0000006.31 0000006.31
Unauthorized Gross:0000000.00 0000000.00
 Meter Creep Gross:0000000.00 0000000.00
    Backflow Gross:0000000.00 0000000.00









          CLeaR  Next  Prev  Exit
```

Parameter Descriptions

Total Gross	Total gross volume through the flow meter.
Authorized Gross	Total authorized gross volume through the flow meter.
Unauthorized Gross	Total unauthorized gross volume through the flow meter.
Meter Creep Gross	Gross amount of volume designated as meter creep. Meter creep volumes are small amounts of volume that have been indicated by the meter when flow is supposed to be idle. Meter creep can be caused by a small leak, excessive line shock or electro-magnetic interference.
Backflow Gross	Total gross volume that has flowed through the meter backwards. This can only be detected with meters using dual pick-offs.

Notes:

- Volume numbers displayed are whole numbers or with 1/100 resolution depending on the current setting of the “Use Hundredths” RCU W&M Parameter.
- The numbers on the left indicate volumes in non-resettable totalizers.
- The numbers on the right indicate volumes in resettable totalizers.

Use the **CLR** key to zero out the resettable totalizers.

10.3.3 VIEWING COMPONENT TOTALIZERS

From the View Totalizers Menu, select Components. After selecting the preset and component, the Component Totalizers screen displays:

```
   PRE #1 CMP #1 (Base 001  ) TOTALIZERS

        Total Gross:000000631 (000000631)
        Total Net  :000000631 (000000631)
        Total Mass :000000631 (000000631)
  Authorized Gross:000000631 (000000631)
  Authorized Net  :000000631 (000000631)
  Authorized Mass :000000631 (000000631)
Unauthorized Gross:000000000 (000000000)
Unauthorized Net  :000000000 (000000000)
Unauthorized Mass :000000000 (000000000)
```

```
   PRE #1 CMP #1 (Base 001  ) TOTALIZERS

        Total Gross:0000006.31 0000006.31
        Total Net  :0000006.31 0000006.31
        Total Mass :0000006.31 0000006.31
  Authorized Gross:0000006.31 0000006.31
  Authorized Net  :0000006.31 0000006.31
  Authorized Mass :0000006.31 0000006.31
Unauthorized Gross:0000000.00 0000000.00
Unauthorized Net  :0000000.00 0000000.00
Unauthorized Mass :0000000.00 0000000.00
```

Parameter Descriptions

Total Gross	Total gross volume of the component delivered.
Total Net	Total net volume of the component delivered.
Total Mass	Total mass of the component delivered.
Authorized Gross	Total authorized gross volume of the component delivered.
Authorized Net	Total authorized net volume of the component delivered.
Authorized Mass	Total authorized mass of the component delivered.
Unauthorized Gross	Total unauthorized gross volume of the component delivered.

Unauthorized Net	Total unauthorized net volume of the component delivered.
Unauthorized Mass	Total unauthorized mass of the component delivered.

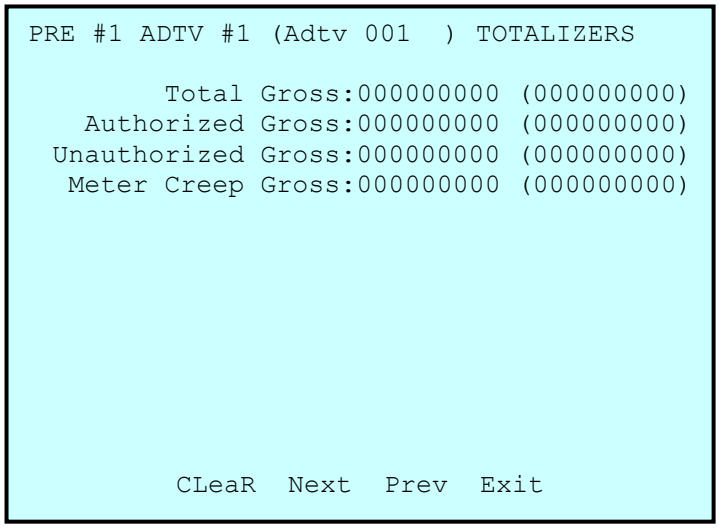
Notes:

- Volume numbers displayed are whole numbers or with 1/100 resolution depending on the current setting of the “Use Hundredths” RCU W&M Parameter.
- The numbers on the left indicate volumes in non-resettable totalizers.
- The numbers on the right indicate volumes in resettable totalizers.

Use the **CLR** key to zero out the resettable totalizers.

10.3.4 VIEWING ADDITIVE TOTALIZERS

From the View Totalizers Menu, select Additives. After selecting the preset and additive, the Additive Totalizers screen displays:


PRE #1 ADTV #1 (Adtv 001) TOTALIZERS
Total Gross:000000000 (000000000)
Authorized Gross:000000000 (000000000)
Unauthorized Gross:000000000 (000000000)
Meter Creep Gross:000000000 (000000000)
CLeaR Next Prev Exit

Parameter Descriptions:

Total Gross	Total gross volume through the additive meter.
Authorized Gross	Total authorized gross volume through the additive meter.
Unauthorized Gross	Total unauthorized gross volume through the additive meter.
Meter Creep Gross	Gross amount of volume designated as meter creep. Meter creep volumes are small amounts of volume that have been indicated by the meter when flow is supposed to be idle. Meter creep can be caused by a small leak, excessive line shock or electro-magnetic interference.

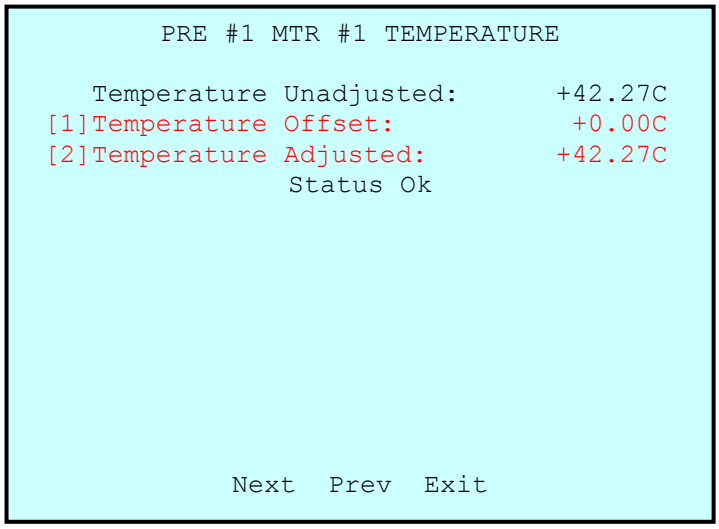
Notes:

- Numbers are displayed in 1/1000th of unit of measure. A decimal point is implied three positions to the right of the least significant number.
- The numbers on the left indicate volumes in non-resettable totalizers.
- The numbers on the right indicate volumes in resettable totalizers.

Use the **CLR** key to zero out the resettable totalizers.

10.4 VIEWING TEMPERATURES

From the Views and Inquiry Menu select Temperature. After selecting the preset and meter, the Temperature screen displays:

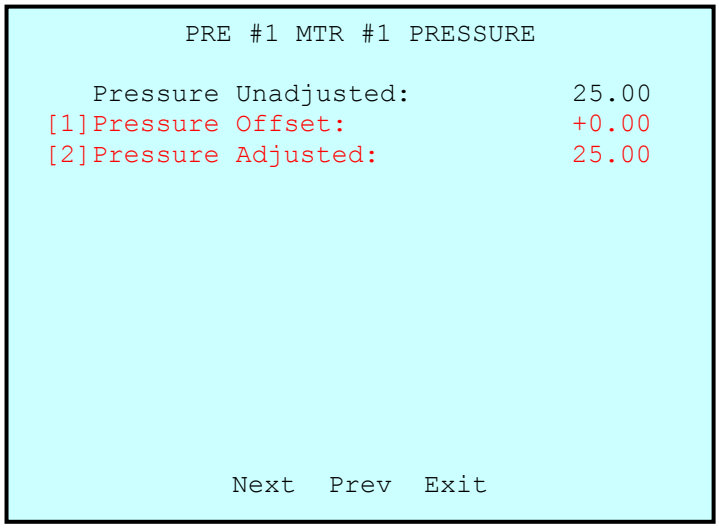


Parameter Descriptions:

Temp Unadjusted	Displays the Resistance Temperature Detector real-time temperature.
Temp Offset	Displays the current temperature offset value, which is the difference between the Temp Unadjusted value and the Temp Adjusted (observed temperature) value.
Temp Adjusted	Displays the observed temperature as a result of applying the temperature offset.

10.5 VIEWING PRESSURES

From the Views and Inquiry Menu select Pressure. After selecting the preset and meter, the Pressure screen displays:

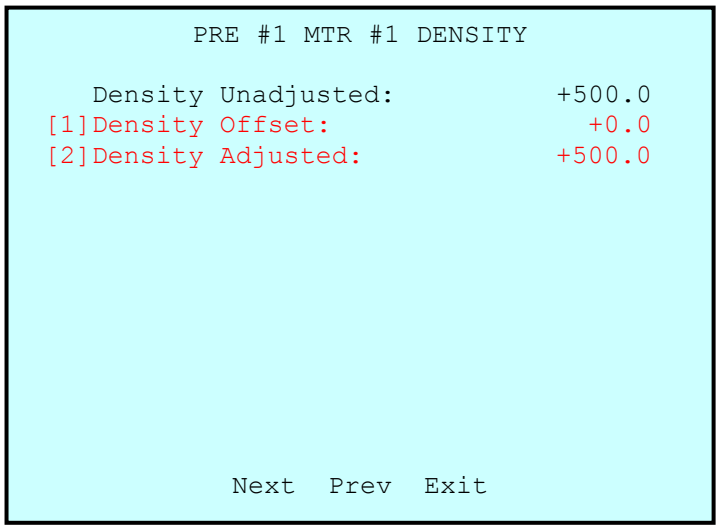


Parameter Descriptions:

Pressure Unadjusted	Displays the real-time pressure.
Pressure Offset	Displays the pressure offset value, which is the difference between the Pressure Unadjusted value and the Pressure Adjusted (observed pressure) value.
Pressure Adjusted	Displays the observed pressure as a result of applying the pressure offset.

10.6 VIEWING DENSITY

From the Views and Inquiry Menu select Density. After selecting the preset and meter, the Density screen displays:

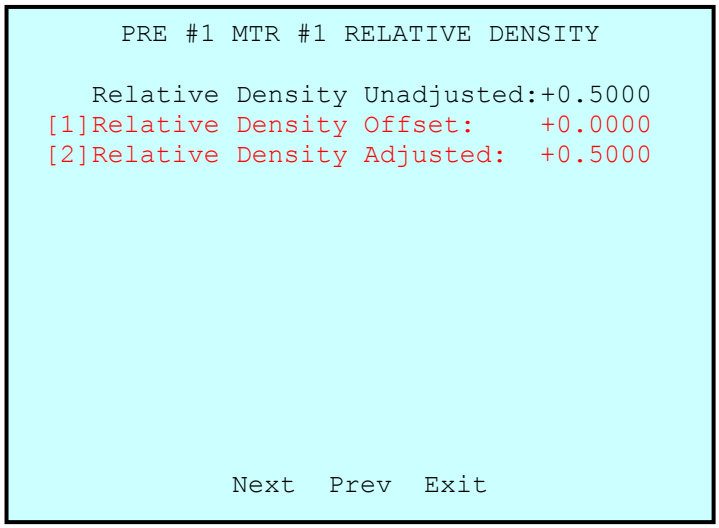


Parameter Descriptions:

Parameter	Description
Density Unadjusted	Displays the real-time density.
Density Offset	Displays the current Density offset value, which is the difference between the Density Unadjusted value and the Density Adjusted (observed density) value.
Density Adjusted	Displays the observed density as a result of applying the density offset.

10.7 VIEWING RELATIVE DENSITY

From the Views and Inquiry Menu select Relative Density. After selecting the preset and meter, the Relative Density screen displays:

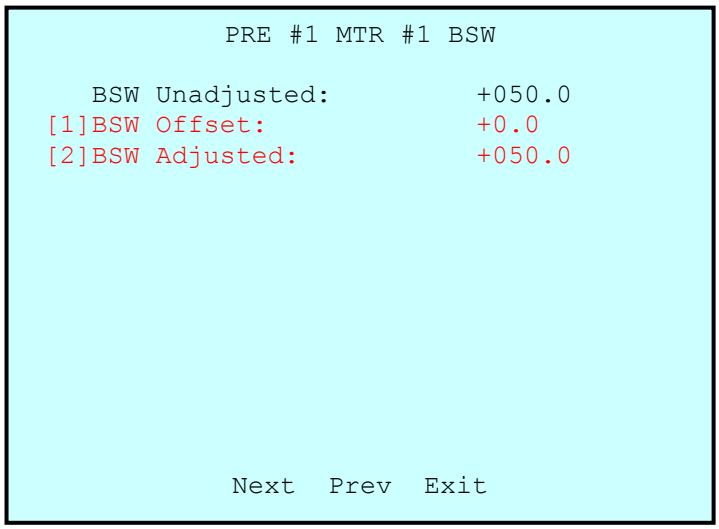

PRE #1 MTR #1 RELATIVE DENSITY
Relative Density Unadjusted:+0.5000
[1]Relative Density Offset: +0.0000
[2]Relative Density Adjusted: +0.5000
Next Prev Exit

Parameter Descriptions:

Parameter	Description
Relative Density Unadjusted	Displays the real-time relative density.
Relative Density Offset	Displays the current Relative Density offset value, which is the difference between the Relative Density Unadjusted value and the Relative Density Adjusted (observed relative density) value.
Relative Density Adjusted	Displays the observed relative density as a result of applying the relative density offset.

10.8 VIEWING BSW

From the Views and Inquiry Menu select BSW. After selecting the preset and meter, the BSW screen displays:

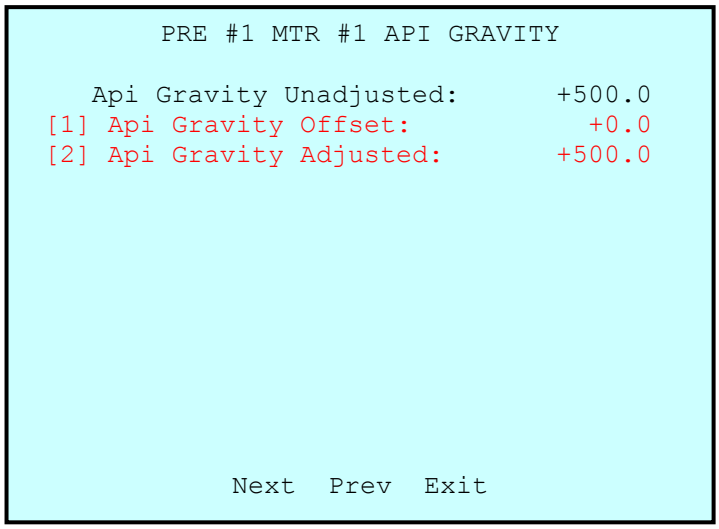


Parameter Descriptions:

Parameter	Description
BSW Unadjusted	Displays the real-time BSW.
BSW Offset	Displays the current BSW offset value, which is the difference between the BSW Unadjusted value and the BSW Adjusted (observed relative density) value.
BSW Adjusted	Displays the observed BSW as a result of applying the BSW offset.

10.9 VIEWING API GRAVITY

From the Views and Inquiry Menu select Api Gravity. After selecting the preset and meter, the Api Gravity screen displays:

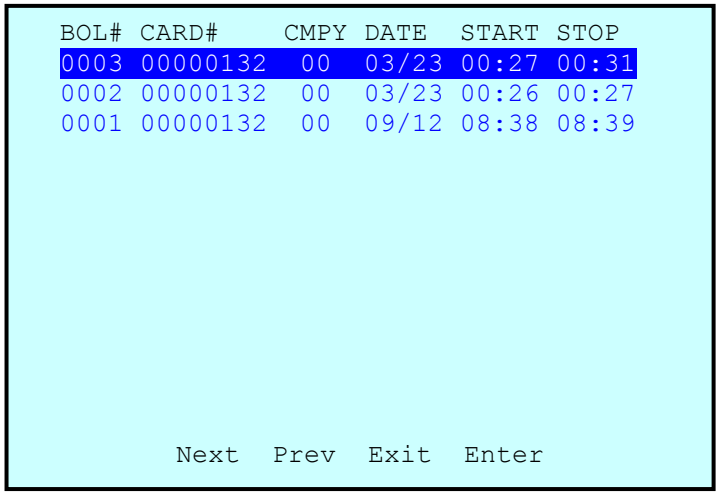


Parameter Descriptions:

Parameter	Description
Api Gravity Unadjusted	Displays the real-time Api Gravity.
Api Gravity Offset	Displays the current Api Gravity offset value, which is the difference between the Api Gravity Unadjusted value and the Api Gravity Adjusted (observed relative density) value.
Api Gravity Adjusted	Displays the observed Api Gravity as a result of applying the Api Gravity offset.

10.10 VIEWING TRANSACTIONS

Use the Transactions inquiry function to view Bill of Lading (BOL) load transactions.
It is also possible to go straight to this view screen via code 4447 combined with NEXT.
Select **Transactions** from the Views and Inquiries screen. The View Transactions Screen displays:



Current transactions are listed on the screen that appears:

Field Descriptions:

BOL#	Bill of Lading number.
CARD#	Driver's card number.
CMPY	Company ID number. Two-digit ID associated with the driver card. Used for stand-alone mode only.
DATE	Date on which the load occurred.
START	Load start time.
STOP	Load complete time.

Select a transaction to view it in more detail. The View Transaction Header Screen displays:

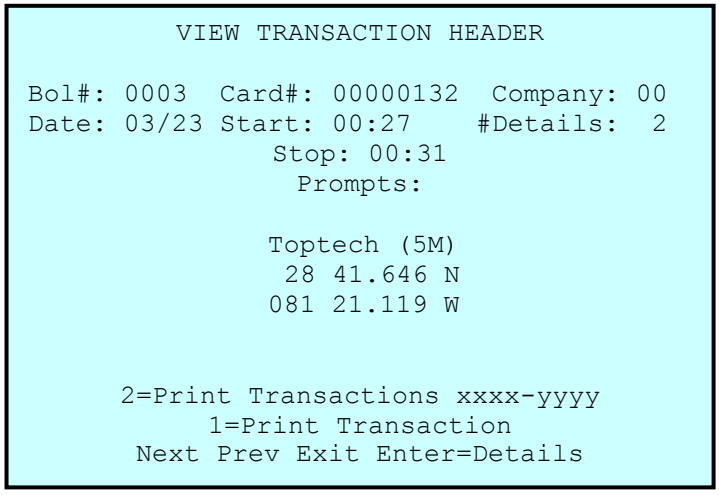


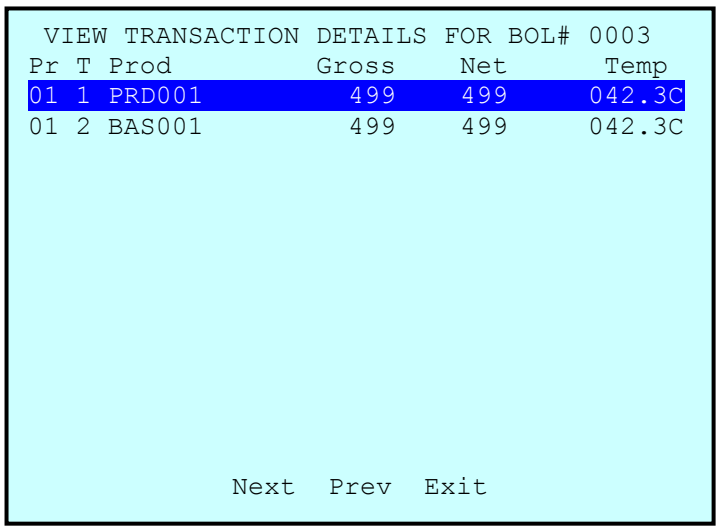
Figure 10.1 View Transaction Header Screen

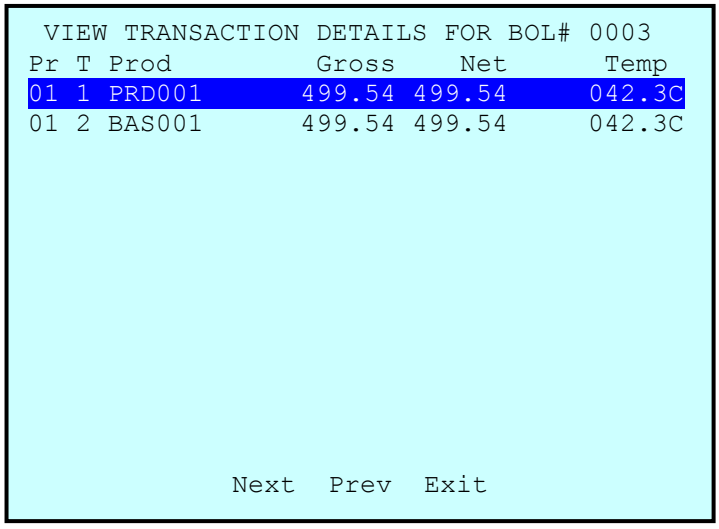
#Details	Indicates the number of detail lines for this transaction.
Prompts	Optional configurable prompts: Stockholder ID, Customer ID, Account ID, and Trailer ID. (ML II Mobile Only) When GPS Communication is configured, Prompts #3 and #4 will contain the Latitude and Longitude position at authorization. When "Max GPS Site Distance" is configured, Prompt #2 will contain the Site Name and Distance from the site.

If a COM port is defined as PRINT,

- The "1=Print Transaction" is displayed. Pressing '1' will print the currently selected transaction.
- The "2=Print Transactions xxxx-yyyy" when a second transaction is viewed. xxxx-yyyy is the Bol# of the last two transactions viewed indicating the range of transaction to print. Pressing '2' will print the selected transaction range.
- If this is a reprint of the transaction, the printed transaction will be labeled as "Duplicate".

Press **Enter** to view detail data for the transaction (products, gross, net, temp., etc.). The Transaction Detail Screen displays:

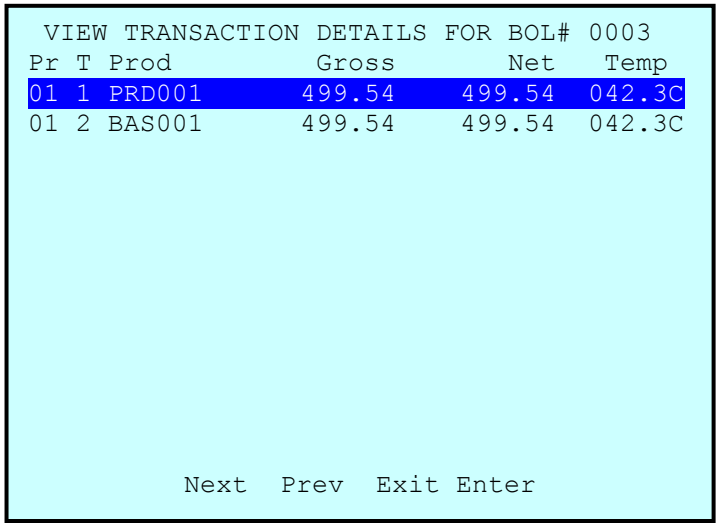

VIEW TRANSACTION DETAILS FOR BOL# 0003
Pr T Prod Gross Net Temp
01 1 PRD001 499 499 042.3C
01 2 BAS001 499 499 042.3C
Next Prev Exit


VIEW TRANSACTION DETAILS FOR BOL# 0003
Pr T Prod Gross Net Temp
01 1 PRD001 499.54 499.54 042.3C
01 2 BAS001 499.54 499.54 042.3C
Next Prev Exit

(1/100 resolution is displayed when the Use Hundredths RCU W&M parameter is enabled)

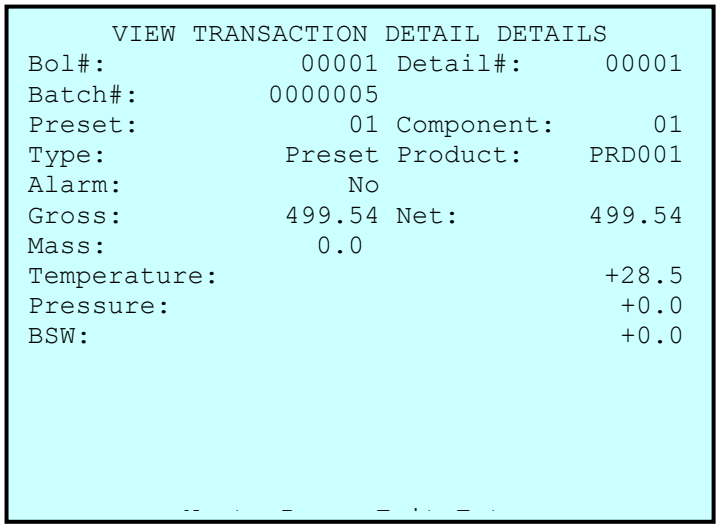
Pr	Preset Number (Always 1 on MultiLoad II SMP).

Typ	Product Type: 1=Saleable Product Recipe; 2=Component; 3=Additive; 4=Meter, 5=Preset Totalizer, 6=Meter Totalizer, 7=component Totalizer, 8=Additive Totalizer
Prod	Product ID.
Gross	Gross Volume.
Net	Net Volume.
Temp	Temperature.
Dens	Density/Relative Density/Gravity.
CP	Compartment #.


VIEW TRANSACTION DETAILS FOR BOL# 0003
Pr T Prod Gross Net Temp
01 1 PRD001 499.54 499.54 042.3C
01 2 BAS001 499.54 499.54 042.3C
Next Prev Exit Enter

Any Batch that had an alarm occur during delivery where the accuracy may be in question, will be Highlighted in RED.

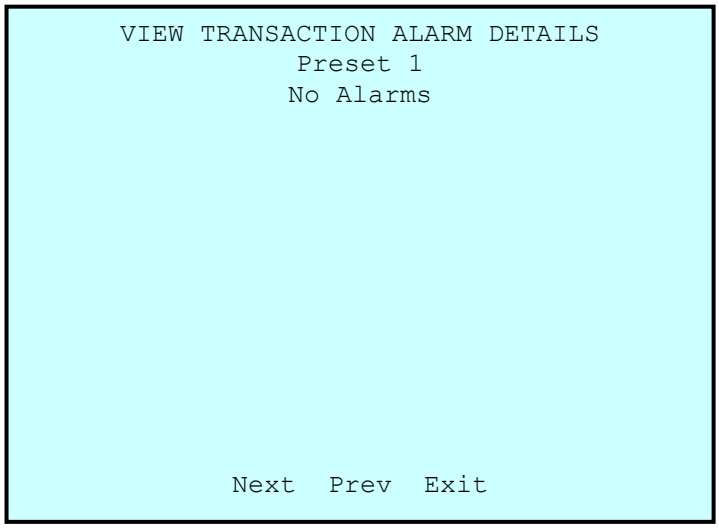
Select a batch and press Enter to view details.



Bol#	Bol # sequence number from Multiload2

Detail	Number of details of 1 transaction (1 to 99)
Batch#	Batch# sequence number from Multiload2 for each loaded batch the number will be increased by 1
Preset	Preset or Arm which was used during loading
Component	Component which is loaded
Type	Product Type: 1=Saleable Product Recipe; 2=Component; 3=Additive; 4=Meter, 5=Preset Totalizer, 6=Meter Totalizer, 7=component Totalizer, 8=Additive Totalizer
Product	Name of the Product (Saleable, Component , Additive)
Alarm	If their was an alarm for that transaction
Gross	Gross Volume.
Net	Net Volume.
Mass	Mass
Temperature	Temperature of the load
Pressure	Pressure of the load
BSW	Bottom Sediment Water (percentage %)
Density	Density of the load
Relative Density	Relative Density of the load
API Gravity	API Gravity of the load
API Table	Name of the API-table that is used for that batch
Vcf	Vcf- factor which is used during the loading

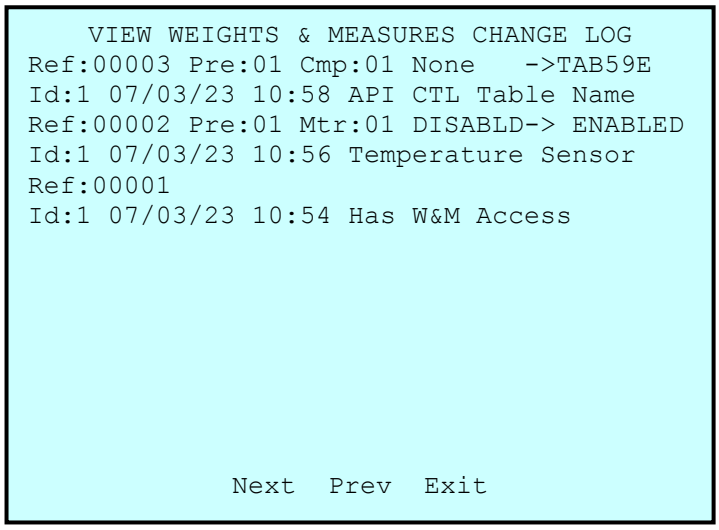
MultiLoad stores by batch the alarms which occurred during loading for all alarm levels except the bay level. Select the alarm and press Enter to view Alarm details.



Pressing Next will show all alarm levels by Preset, Meter, Component and Additive.

10.11 VIEW WEIGHTS AND MEASURES CHANGE LOG

Select **W&M Change Log** from the Views and Inquiries screen. The W&M Change Log Screen displays:


VIEW WEIGHTS & MEASURES CHANGE LOG
Ref:00003 Pre:01 Cmp:01 None ->TAB59E
Id:1 07/03/23 10:58 API CTL Table Name
Ref:00002 Pre:01 Mtr:01 DISABLD-> ENABLED
Id:1 07/03/23 10:56 Temperature Sensor
Ref:00001
Id:1 07/03/23 10:54 Has W&M Access
Next Prev Exit

The most recent entry will be displayed at the top of the screen. To view earlier entries, press the **Next** key to scroll through the earlier entries.

Note: To quickly return to the most recent entry, press **Exit** and re-select the View option.

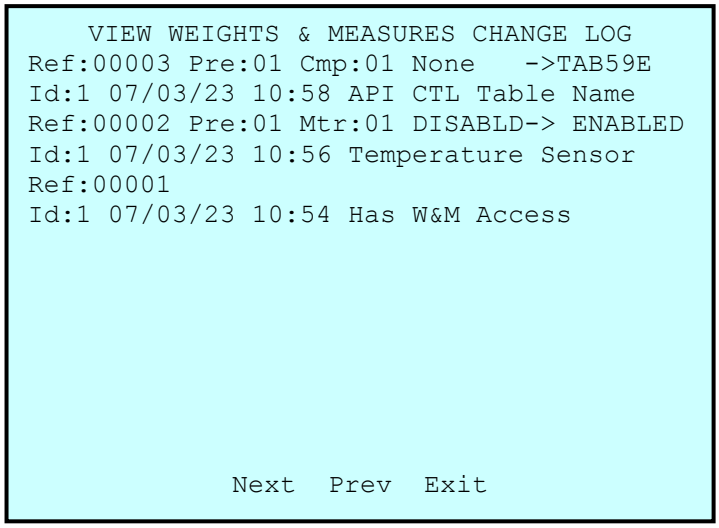
Printing the W&M Change Log - Select Print to have the log printed. A serial printer must be connected to Com Port 2 of the MultiLoad II to print this log. Com Port 2 must be configured as "Print" on the Communication Setup screen to print the W&M Change Log.

Each event will contain two lines of data. The first line will consist of the following:

1. **Reference Number**-Up to 1000 entries will be retained in the log. After 1000 entries have been logged, the oldest entry will be dropped. No reference number will be repeated until 65,535 events have been entered in the log.
2. **Preset Identification**-This field describes the preset (load arm) that is relevant to the event. This value will always be 1 on MultiLoad II SMP. Example: Pre:01 indicates that an event has occurred relevant to load arm #1. The numeric designation that follows the Pre prefix is an arbitrary designation made by the facility engineer. This is established during system configuration.
3. **Component or Meter Identification**-This field will indicate that a component level change was made or that a meter level change was made. Since a load arm can have multiple components (liquids) or meters assigned to it, a numeric indicator will identify which of the load arm's components or meters is referenced. Component level changes may include settings such as meter factors, flow rates and VCF configurations. Meter level changes may include settings such as Temperature and Pressure configurations. This field will indicate CMP:xx for a component change event or MTR:xx for a meter change event. The numeric designation that follows the Cmp or Mtr prefixes is an arbitrary designation made by the facility engineer. This is established during system configuration.
4. **Parameter Value Change**-This field will indicate the previous parameter value followed by the new value. For example 2400->2500 indicates that the value was changed from 2400 to 2500.

The second line of data will contain the following data:

1. **Identification Number**-This field will contain a numeric designation that will identify which individual caused the event. Up to five individual passwords can be assigned to authorized personnel. If the value in this field is the number 1, it means that the person who was assigned password number 1 caused the change log event to occur. If the value in this field is the letter C, it means that parameter changes were made by remote computer across the communication port. Changes to protected parameters cannot be made via remote computer unless the Weights & Measures key switch has been activated. Assignments for the passwords are made in the RCU General Setup menu under Configuration Menu.
2. **Date**-This field will indicate the date that the parameter change was made.
3. **Time**-This field will indicate the time that the parameter change was made.
4. **Parameter Name**-This field will identify the parameter that was changed, causing the event.


VIEW WEIGHTS & MEASURES CHANGE LOG
Ref:00003 Pre:01 Cmp:01 None ->TAB59E
Id:1 07/03/23 10:58 API CTL Table Name
Ref:00002 Pre:01 Mtr:01 DISABLD-> ENABLED
Id:1 07/03/23 10:56 Temperature Sensor
Ref:00001
Id:1 07/03/23 10:54 Has W&M Access
Next Prev Exit

```
Ref:00003 Pre:01 Cmp:01 None   ->TAB59E
Id:1 07/03/06 10:54 API CTL Table Name
```

The most recent entry from the example is event 00003. It indicates that on preset (load arm) #1, the API CTL Table of component #1 was changed from None to Table 59E. This change occurred at 10:58 on March 23, 2007.

Every two lines constitute a full message.

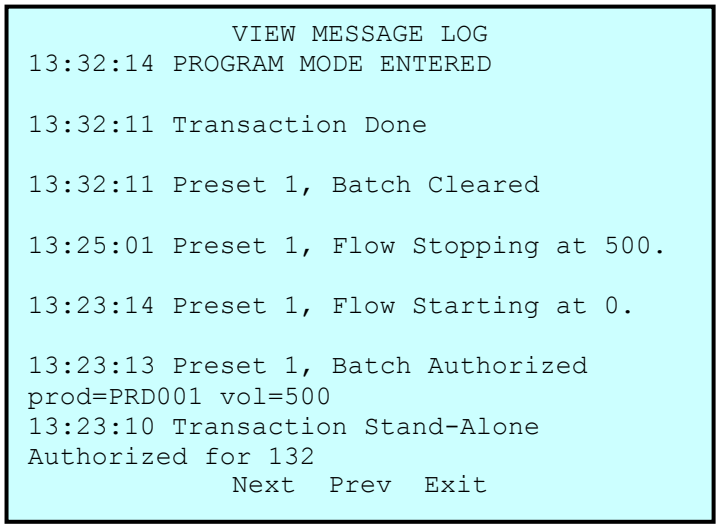
- The Message Log can be sent to a serial printer. Go into the Communication Setup screen and set COM2 to Print before entering the View Weights & Measures Change Log screen.
- The Weights and Measures change log can be viewed and printed without entering the program mode, by pressing the following 5 key sequence: 4449 NEXT.
- The View Totalizers menu can be viewed and printed without entering the program mode, by pressing the following 5 key sequence: 4448 NEXT.
- The View Transactions screen can be viewed and printed without entering the program mode, by pressing the following 5 key sequence: 4447 NEXT.

10.12 VIEW MULTILOAD II MESSAGE LOG

The MultiLoad II Message Log is a real-time event log. All authorization attempts, flow starts, flow stops, alarms (raised or cleared), and various other events are logged with their dates and times. Particular events will also cause totalizer values to be logged.

From the Views and Inquiry Menu select **Message Log**.

The View Message Log screen displays.

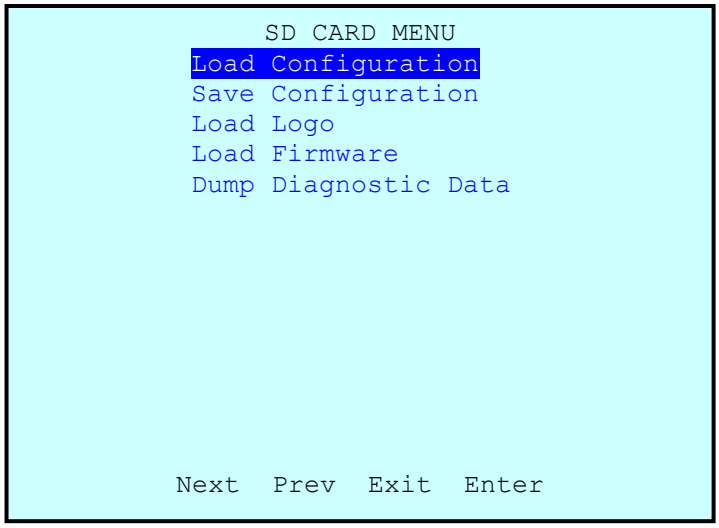

VIEW MESSAGE LOG
13:32:14 PROGRAM MODE ENTERED
13:32:11 Transaction Done
13:32:11 Preset 1, Batch Cleared
13:25:01 Preset 1, Flow Stopping at 500.
13:23:14 Preset 1, Flow Starting at 0.
13:23:13 Preset 1, Batch Authorized
prod=PRD001 vol=500
13:23:10 Transaction Stand-Alone
Authorized for 132
Next Prev Exit

Every two lines constitute a full message with the time of the log entry. The most recent entry will be displayed at the top of the screen. To view earlier entries, press the **Next** key to scroll through the earlier entries.

CHAPTER 11 SD CARD

11.1 OVERVIEW

On MultiLoad II CPU boards manufactured after 1/1/2011 there exists an SD Card slot above the processor board. This SD Card slot allows the quick loading and saving of configuration files as well as the loading of customer logo files and firmware updates. The MultiLoad II firmware version 4.xx.xx provides a SD Card functions menu available from the MAIN MENU, shown below:



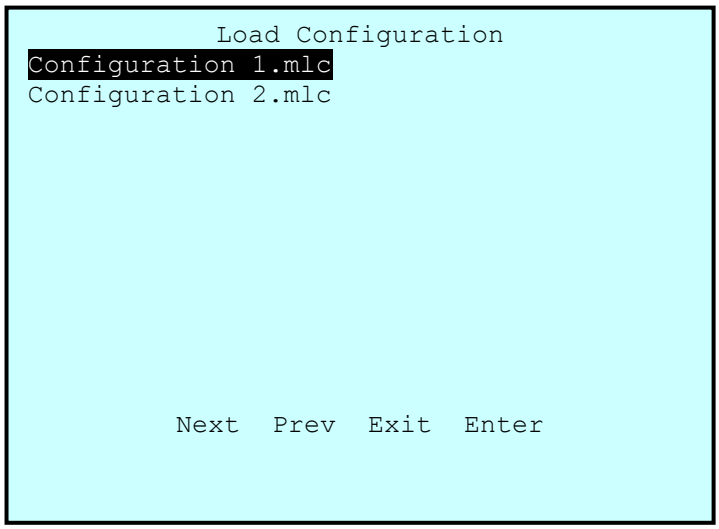
A formatted SD Card must be inserted into the SD Card slot on the CPU board before selecting any of the options above or a “Not Accessible” message will be displayed.

NOTE: Each file list will only show associated file extensions (*.mlc , *.bin or *.bmp).

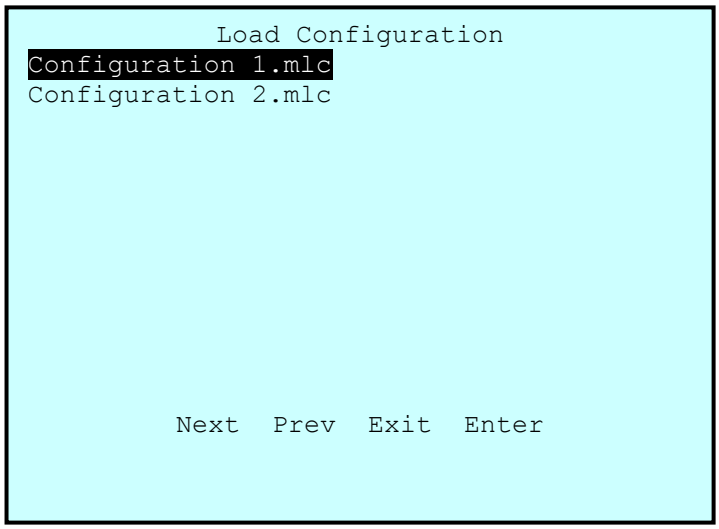
11.2 LOAD CONFIGURATION

From the SD Card menu, select **Load Configuration**.

The Load Configuration screen displays files on the SD Card.

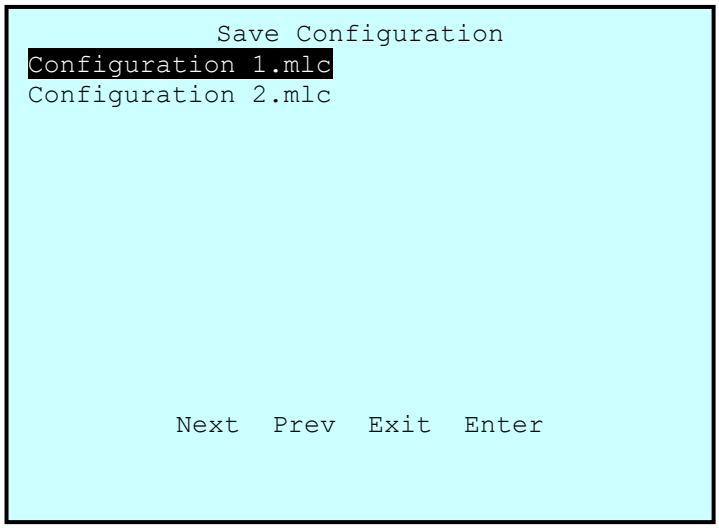


Select the configuration file to load. The number of accepted and rejected parameters are displayed. Parameters may be rejected if the parameter is out of range, or the parameter is attempting to change a W&M protected parameter without the W&M key active.

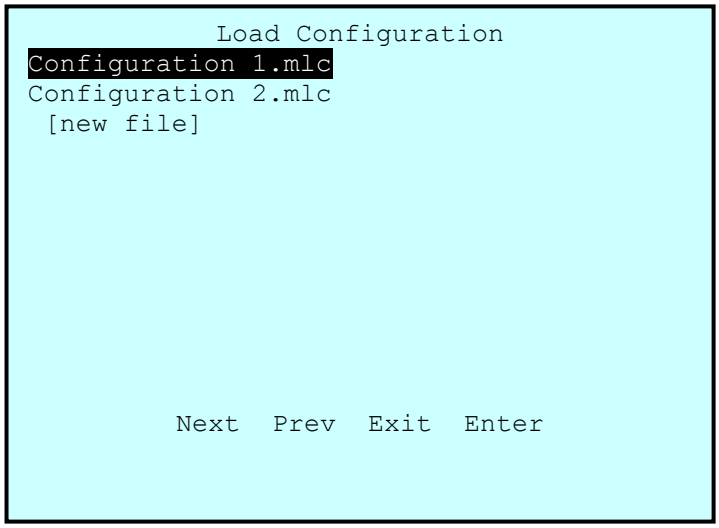


11.3 SAVE CONFIGURATION

From the SD Card menu, select **Save Configuration**.
The Save Configuration screen displays files on the SD Card.



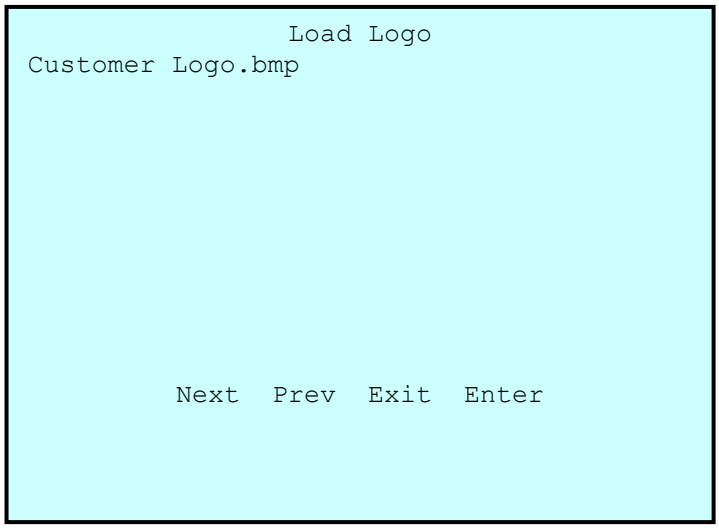
Select the configuration file or create a new file to save the configuration.



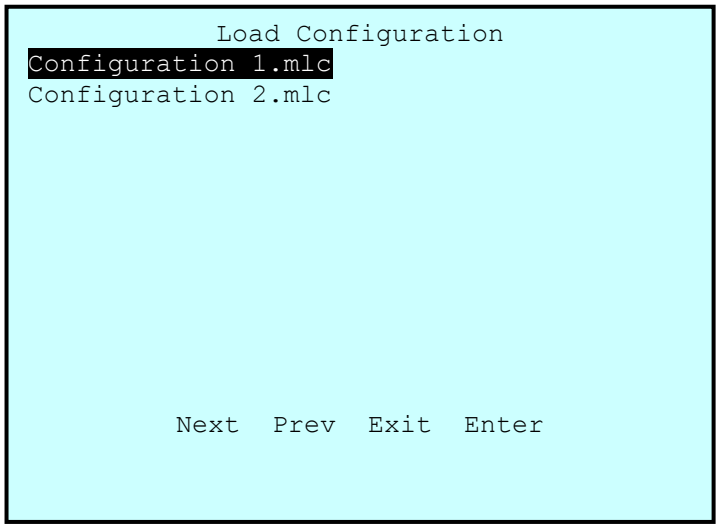
11.4 LOAD LOGO

From the SD Card menu, select **Load Logo**.

The Load Logo screen displays files on the SD Card.



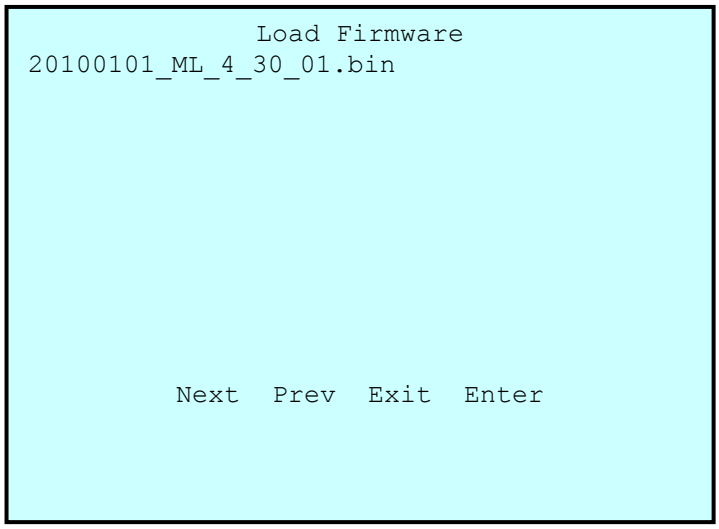
Select the logo file to load. The logo file MUST be a BMP file with a resolution of 640x240x16 colors. Any file format or color issues will be displayed if the file cannot be loaded. It is recommended that the logo file to create with the MultiMate program. After the file is loaded the following screen will be displayed.



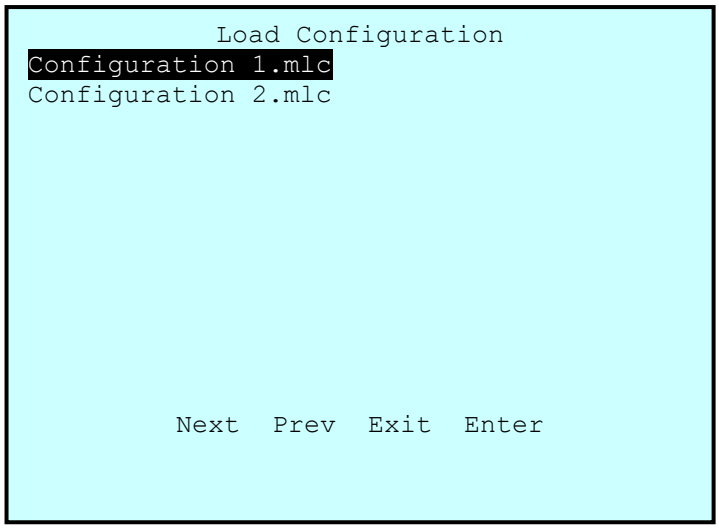
11.5 LOAD FIRMWARE

From the SD Card menu, select **Load Firmware**.

The Load Firmware screen displays files on the SD Card.



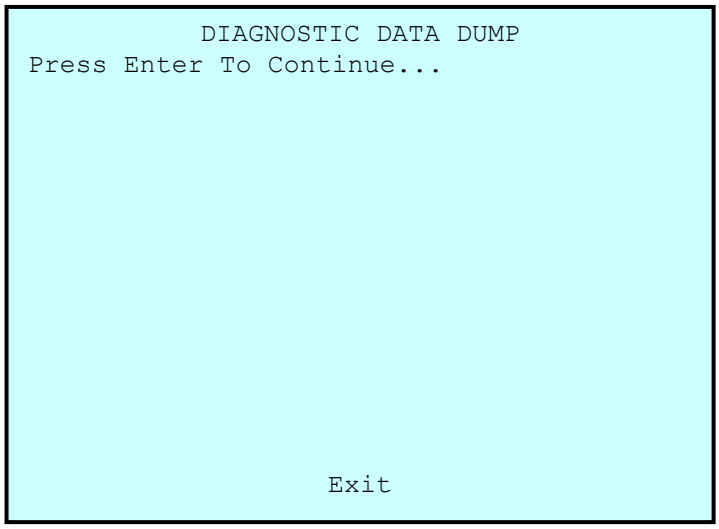
Select the firmware file to load. The W&M switch must be active and the firmware file image will be verified before it is accepted and loaded into flash memory.



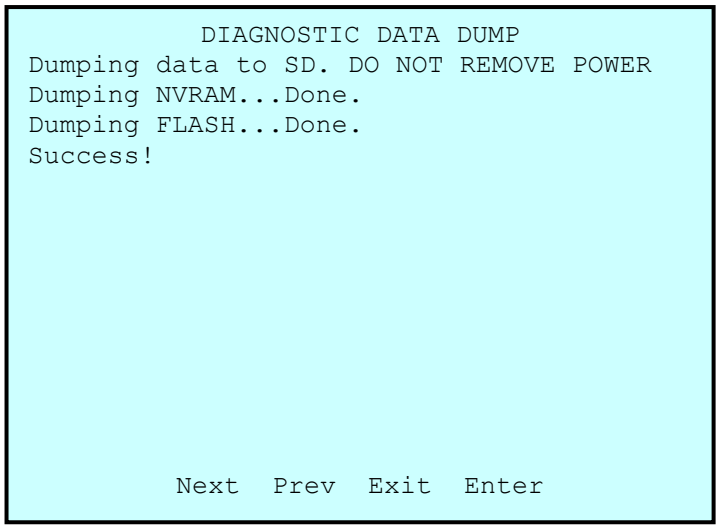
11.6 DUMP DIAGNOSTIC DATA

From the SD Card menu, select **Dump Diagnostic Data**.

The Dump Diagnostic Data screen prompts for Enter before continuing.



Make sure an SD card is inserted in the Multiload unit and press Enter. The NVRAM and FLASH is written to the SD card as NVRAM.BIN and FLASH.BIN, respectively. Provide the files to Toptech Support for analysis.



CHAPTER 12 OPERATION

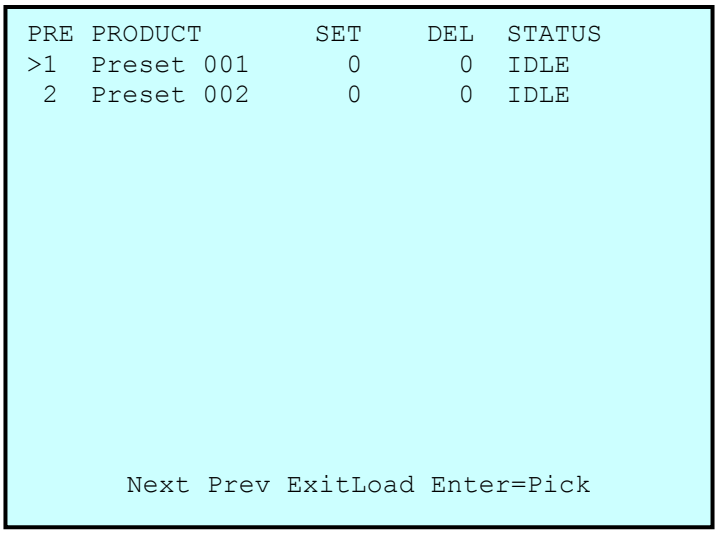
12.1 OVERVIEW

This chapter discusses the two methods of MultiLoad II operation: Remote Control and Local Control.

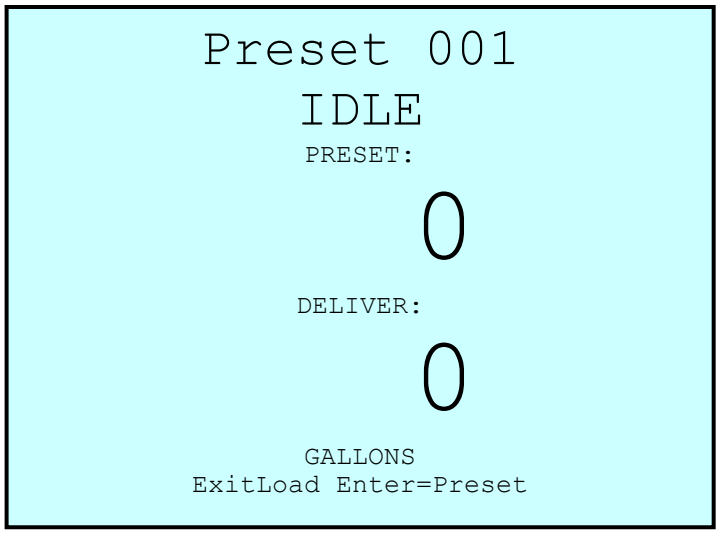
Under Remote Control, the MultiLoad II relies on TMS to handle all driver data entry tasks and product authorization.

Under Local Control, the MultiLoad II handles driver data entry tasks and data validation via internal configuration and stored validation lists.

On MultiLoad II



On MultiLoad II SMP



(1/100 resolution is displayed when the Use Hundredths RCU W&M parameter is enabled)

12.2 PHASES OF OPERATION

There are four main phases of MultiLoad II operation:

Phase 1 – Authorization

Phase 2 – Preset

Phase 3 – Loading

Phase 4 – End Load

12.3 DRIVER CARD OR KEYPAD ACCESS

To begin the authorization process, the MultiLoad II RCU will read a driver's Prox Card (Excluding the SMP) or will prompt the driver to enter an access ID. Next the driver will be prompted to enter a PIN code.

12.4 REMOTE CONTROL OPERATION

The following sequence provides detailed Driver instructions for operating the MultiLoad II in Remote mode, that is, in conjunction with a host system (TMS). It also provides "behind the scenes" information relevant to the System Administrator.

In order to enable Remote operation, the Remote Processing parameter on the RCU General Setup screen (accessed from the Configuration Menu) must be enabled.

12.4.1 AUTHORIZATION PHASE

In Remote mode, the authorization process is more extensive than in Local mode.

Prior to the authorization of a transaction, the host system (TMS) may prompt the driver for any number of prompts, including, but not limited to: Truck, Trailer, Stockholder, Customer, Account, PO number, Release Number, etc.

Prior to the authorization of each batch, the host system (TMS) may prompt the driver for any number of prompts, including, but not limited to: Product, Quantity, Compartment. The host system may also verify the supplied data and check allocations before uploading the product recipe and authorizing the batch.

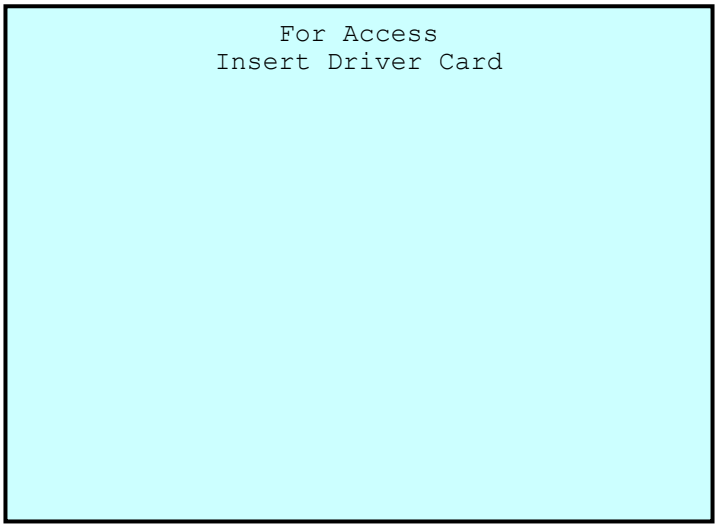
Upon receiving batch authorization from TMS, the MultiLoad II requests the Driver to "Confirm Start" by pressing **Enter** again to start flow.

Upon transaction completion, the host system (TMS) retrieves the transaction data and prints the BOL.

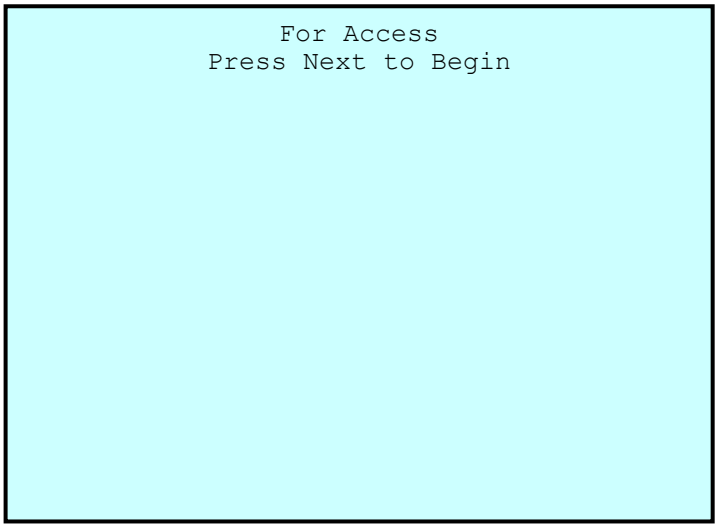
12.4.2 ACCESS SCREEN

When the MultiLoad II is in Operation mode, the **Access** screen displays.

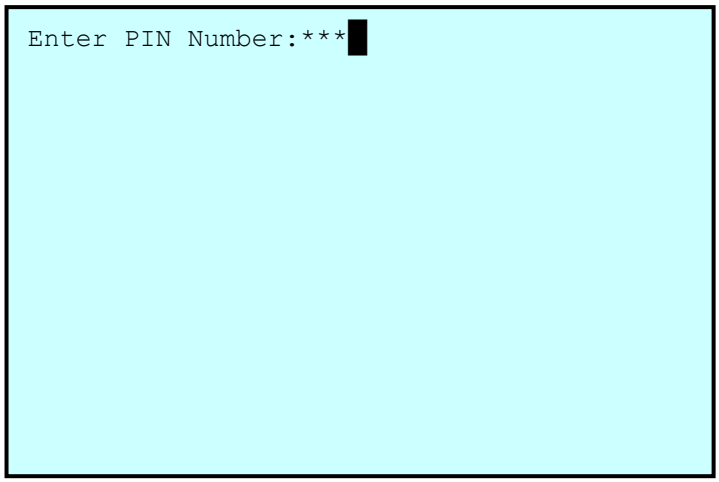
On MultiLoad II



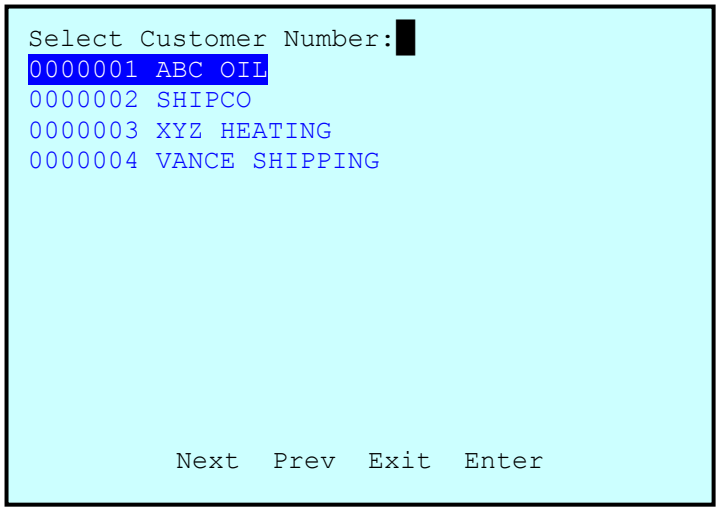
On MultiLoad II SMP



After inserting a driver card or pressing **Next** and entering an Access ID/Driver Number, the driver is prompted for a PIN (Personal Identification Number).

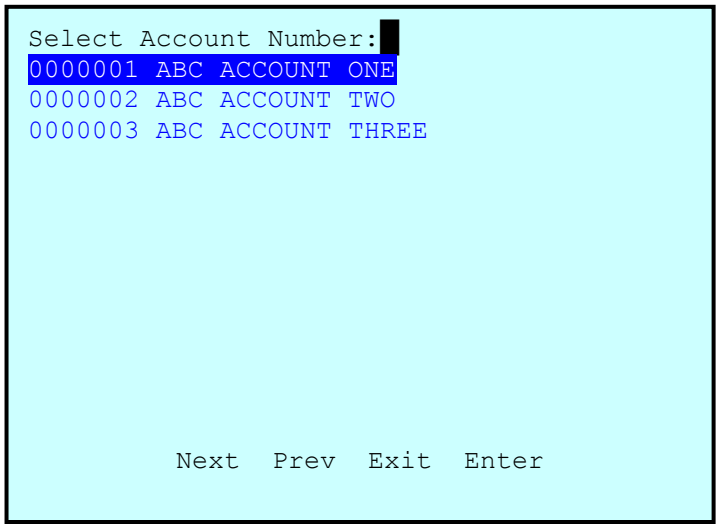


The driver may be prompted for additional information like trailer ID. Afterwards the Customer Selection screen will display:



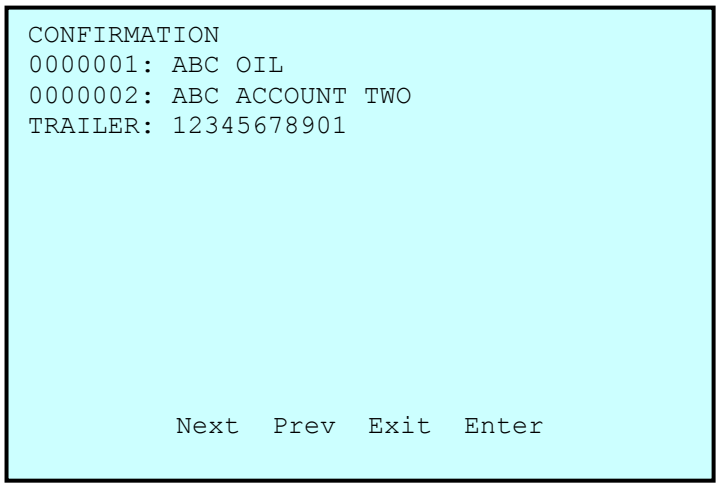
The driver can either select the customer from the picklist or they can key in the customer number at the prompt. In either case, press **Enter**.

If the customer you selected has at least one account defined, the Account Selection screen will display (shown below). If the customer you have selected has no accounts defined, you will go directly to the Confirmation screen.



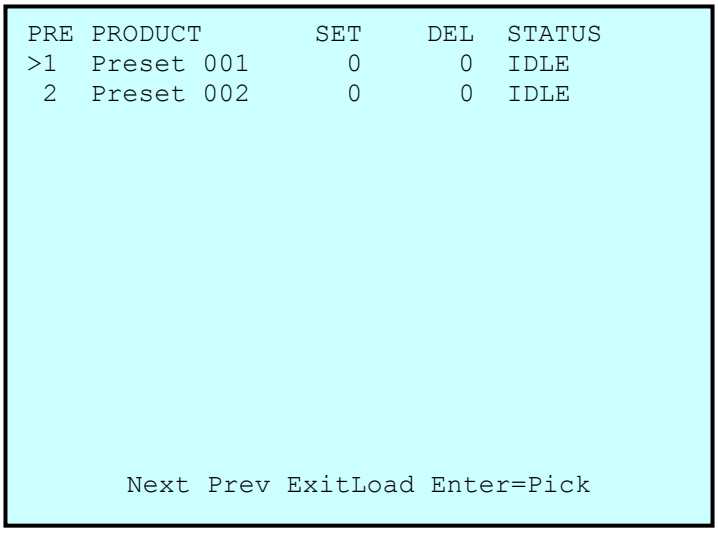
Select the account, or key in the account number at the prompt.

The load Confirmation screen displays:

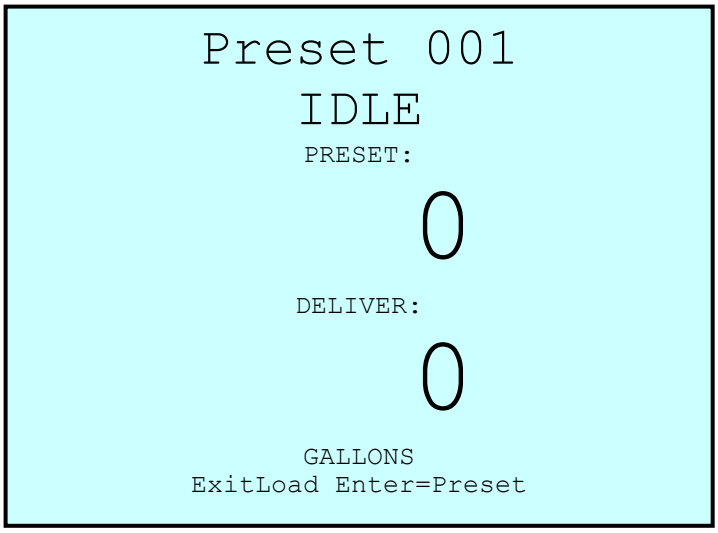


If the information is incorrect, press **Prev** to return to the Customer Selection screen. If the information is correct, press **Enter** to proceed to the Load Screen.

On MultiLoad II

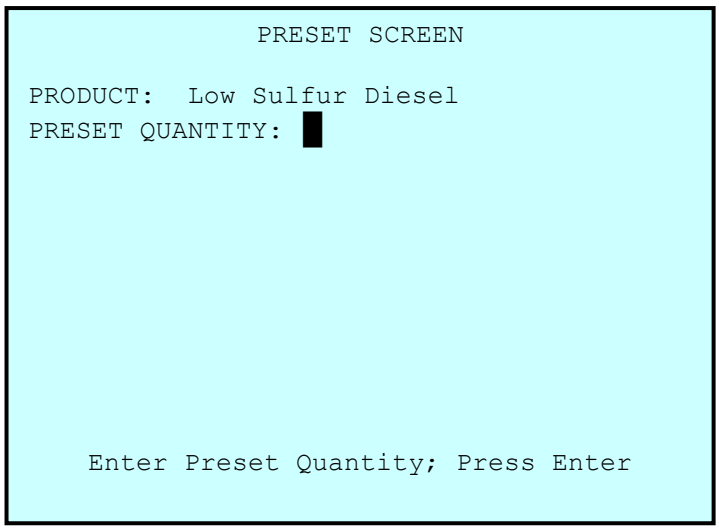


On MultiLoad II SMP



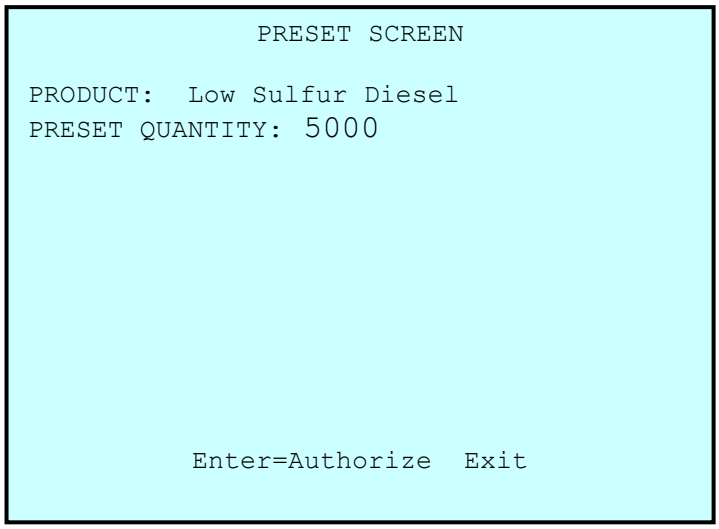
(1/100 resolution is displayed when the Use Hundredths RCU W&M parameter is enabled)

Select a loading arm and press Enter to preset a product to load. The Product Preset screen displays:

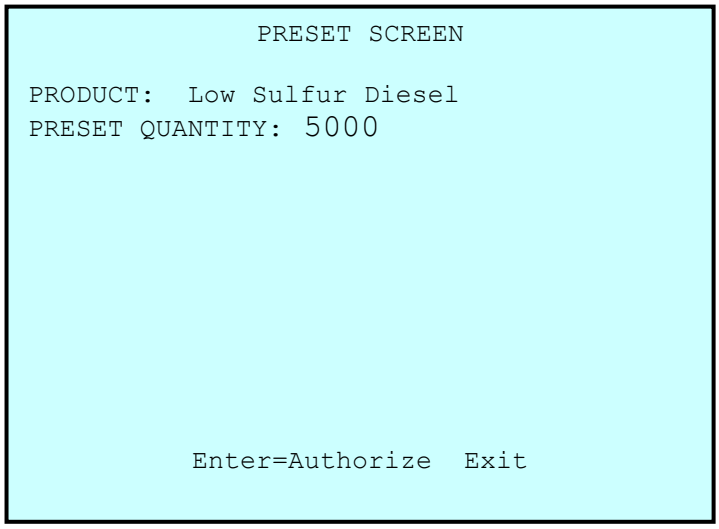


If multiple products can be loaded, selection can be done on this screen.

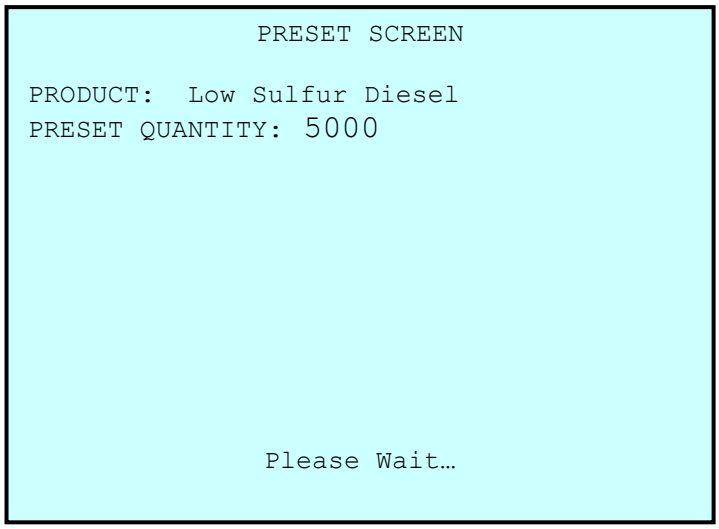
Driver will key in the desired volume to load (e.g., 5000) and press **Enter**



Press **Enter** to have the system authorize the load.

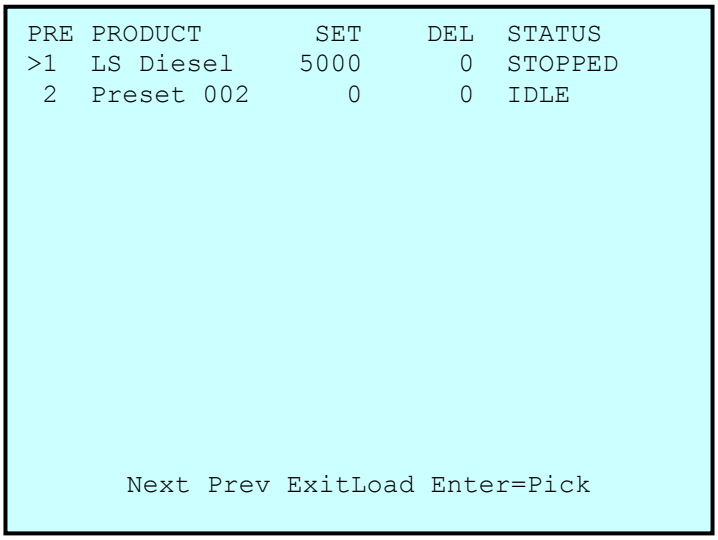


A PLEASE WAIT message displays momentarily while authorization takes place.

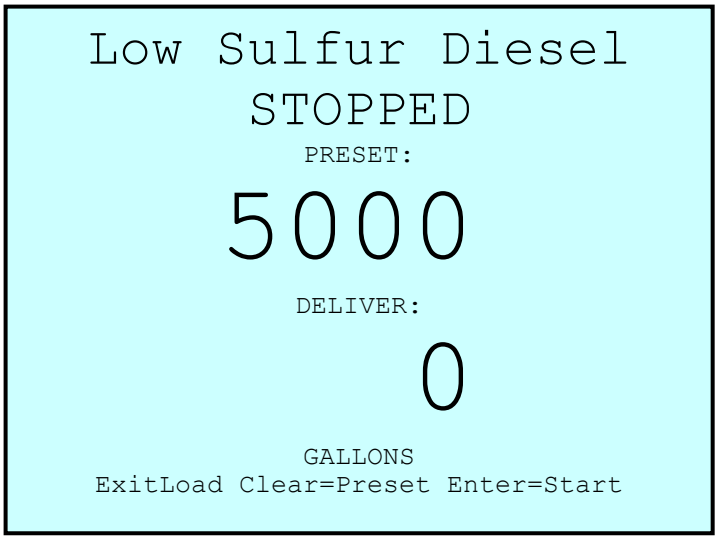


Then the Load Screen displays again.

On MultiLoad II



On MultiLoad II SMP



(1/100 resolution is displayed when the Use Hundredths RCU W&M parameter is enabled)

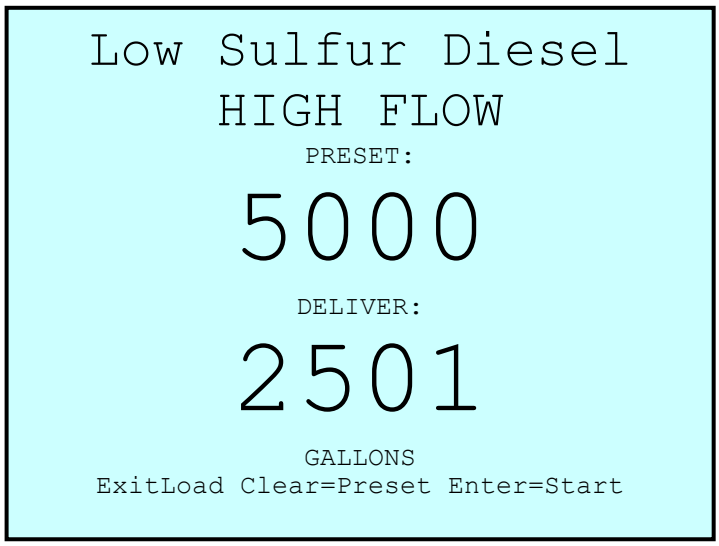
Figure 12.1 Preset Control Screen

Press **Enter** to start the load.

On MultiLoad II

```
PRE PRODUCT        SET    DEL  STATUS
>1  LS Diesel     5000   2501  HIGH FLOW
 2  Preset 002       0      0  IDLE




      Next Prev ExitLoad Enter=Pick
```

On MultiLoad II SMP



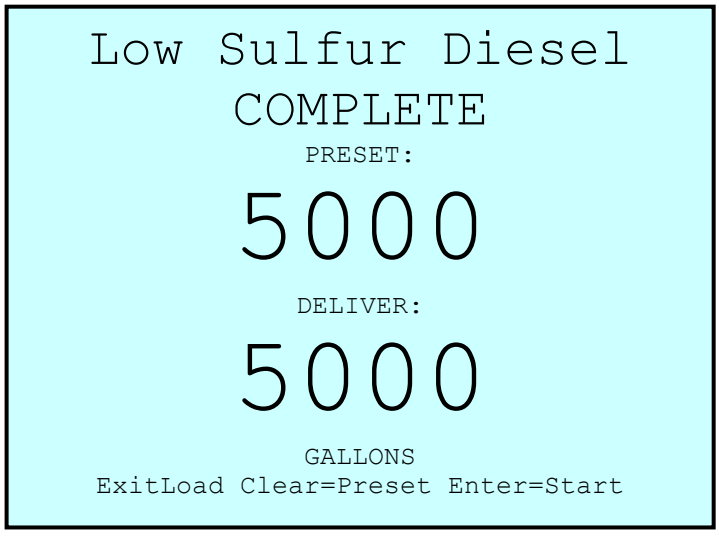
The load starts and as it proceeds you will view the Status change as well as the amount delivered.

When the load completes, the Status will show COMPLETE, the delivered amount should equal the preset amount.

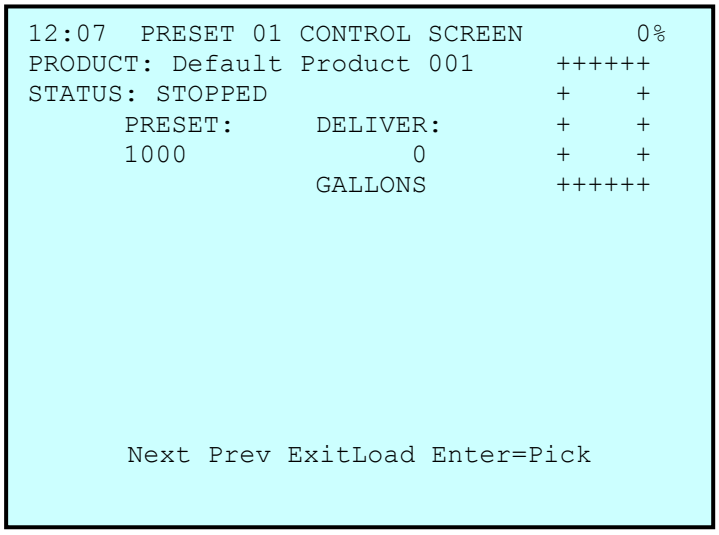
On MultiLoad II

```
PRE PRODUCT        SET    DEL  STATUS
>1  LS Diesel     5000   5000  COMPLETE
 2  Preset 002       0      0  IDLE




      Next Prev ExitLoad Enter=Pick
```

On MultiLoad II SMP



On MultiLoad II



0At the left Top corner the Real Time is added to the loading screen for all devices except SMP.

12.4.3 LOAD STATUS VALUES

*Alarm	Arm is currently has one or more alarms. All Alarm names will start with an * (asterisk).
Unauth	Load Arm is not available for authorization.
Idle	Load Arm is available to be authorized.
Stopped	Load Arm is authorized, no product flowing.
Starting	Load Arm is in the process of starting flow.
Low Flow	After the initial start of a batch, the flow rate will be maintained at the Low Flow Start target flow rate until the Low Flow Start Volume has been delivered.
High Flow	This rate specifies the High Flow target flow rate. This rate will be maintained until the 1st Stage Trip Volume has been reached.
1st Trip	The First Stage Trip phase will begin when the remaining preset volume is equal to the value specified by the First Stage Trip Vol parameter. The First Stage Trip phase is the initial reduction from the High Flow rate to a no flow condition. When the First Stage Trip Volume is reached, the flow control valve will reduce the flow rate from the High Flow Rate to a flow rate specified by the First Stage Flow Rate parameter. The First Stage Trip phase ends when the Second Stage Trip Volume is reached.
2nd Trip	The Second Stage Trip phase will begin when the remaining preset volume is equal to the value specified by the Second Stage Trip Vol parameter. The Second Stage Trip phase is the second in a series of adjustments from the High Flow rate to a No Flow condition. When the Second Trip Volume is reached, the flow control valve will reduce the flow rate from the First Stage Flow Rate to a flow rate specified by the Second Stage Flow Rate parameter. The Second Stage Trip phase ends when the Final Trip Phase is reached
Complete	Load is complete.

For detailed information on the parameters described above, refer to *Chapter 5 – Product Flow Control.*

View Detail Status During Loading

Driver access to these screens can be blocked using the Status Screen Lockout parameter found on the RCU Setup screen from the Configuration Menu.

Pressing the Next and Prev keys will advance through the following load detail screens:

From the Load Screen press **Next**, the Preset Status screen displays.

```
          PRESET 01 STATUS SCREEN
PRODUCT:  Low Sulfur Diesel
STATUS:   COMPLETE
                GROSS       NET
     PRESET:     5000
     REMAIN:        0
     DELIVER:    5000      5000
     TOTAL:      5000

          TEMPERATURE:  24.0C
          PRESSURE:      0.00
          DENSITY:        0.0
          BSW:           0.00
          FLOW RATE:        0

              Next Prev Exit
```

Press the Next key, the Component Status screen displays.

```
   PRESET 01 COMPONENT 01 STATUS SCREEN
PRODUCT: LS DIESEL    STATUS: IDLE
          TARGET   DELIVER     METER
GROSS:      5000      5000      5000
NET:        5000      5000      5000
METER:      5000      5000
TEMPERATURE:            24.00C    24.00C
PRESSURE:                0.00      0.00
DENSITY:                  0.0       0.0
BSW:                     0.00     0.00
CTL(None   ) 1.0000
FLOW RATE:        0



              Next Prev Exit
```

Press the Next key, the Additive Status screen displays.

```
ADD PRODUCT     RECIPE    DEL STATUS
 1  Red Dye      0.000  0.000 INACTIVE









              Next Prev Exit
```

Press the Next key to return to the Load Screen.

12.4.4 END LOAD PHASE

To end a load, the Driver removes the driver card or presses the Exit twice on the Load screen.

Once all flow has been stopped, the MultiLoad II gathers and archives the transaction information. Load data is stored in the MultiLoad II transaction database.

The transaction is completed.

Note: Starting in Multiload II and SMP version 2.29.02, the transaction archive will store the last 10,000 transactions. These archived transactions can be viewed or printed in program mode. Old transactions are deleted in a First-In, First-Out order.

12.4.5 TMS BOL

The host system (TMS) extracts all load data and generates the Bill of Lading.

For information on the RCU Ditto feature, please refer to the *TMS User Manual.*

12.5 LOCAL (STANDALONE) OPERATION

In Local (standalone) Control mode, product and access information are stored in non-volatile memory in the MultiLoad II. (In Remote Control mode, product and access information comes from host system (TMS) databases.)

In Local mode, the MultiLoad II prompts the driver for a PIN code after the driver card or access ID/driver number is verified. This PIN code must match the PIN code of the driver table stored in the non-volatile database of the MultiLoad II.

Once the PIN code is verified, the MultiLoad II will display additional driver prompts, based on its internal configuration. Up to 4 configurable prompts may be presented to the driver. Once the driver completes these prompts, the MultiLoad II will authorize the transaction.

Before operating in Local mode, it is necessary to set up two databases in the MultiLoad II: the Access ID database and a Product database.

12.5.1 ACCESS ID DATABASE

The Access ID database contains the Card Number or Access ID/Driver Number and matching PIN for each driver. Up to 300 Access IDs can be entered into the MultiLoad II. There are two methods to enter this data.

Enter the driver card data manually via the front panel of the MultiLoad II.

Enter the driver card data manually via the MultiLoad II Configuration Tool and upload to the MultiLoad II. (See Upload Registers for procedure.)

Note: Currently there is no support for importing/exporting this data to/from data files. There is also no method of having TMS supply current driver database data to the MultiLoad II. No Customer, Consignee or other Account type information is stored in the MultiLoad II. Drivers can be prompted to enter this information for a transaction, but no customer names or addresses are stored in the MultiLoad II as a configuration. No validation is done on this driver supplied data.

12.5.2 PRODUCT DATABASE

The Product database consists of five categories:

- Base Product definitions
- Saleable Product definitions
- Preset Authorized products
- Base Component Assignments
- Base Additive Assignments

Each category can be entered manually at the MultiLoad II or with the MultiLoad II Configuration Tool, but this information is automatically overwritten by TMS each time the Bay is started with the Product assignments configured in TMS. Note that all products listed will be available to all Drivers when in local mode.

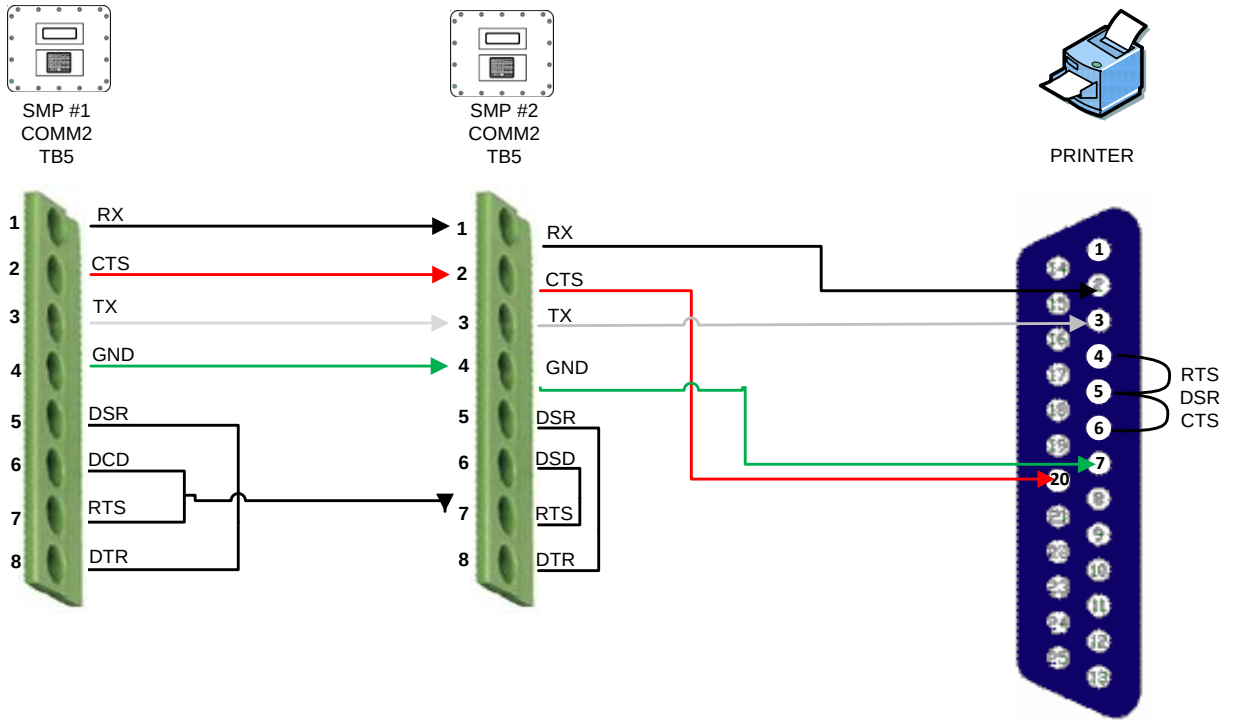
12.5.3 METER TICKET PRINTING

If Meter Ticket printing is needed, a Serial Line Printer will need to be connected directly to the Com 2 MultiLoad II. After a printer is connected, the correct COM parameters and PRINT option must be selected in the Configuration -> Communication Setup section and Ticket Printing must be Enabled in the RCU Setup section.

A default Meter Ticket format is stored in the MultiLoad II. This can be reconfigured without software changes, but not manually through the MultiLoad II or MultiLoad II Configuration tool. Please contact Toptech for Meter Ticket format reconfiguration. Hazard warnings are also configurable per product.

On the MultiLoad II Mobile, the default ticket has been configured for a small 4.5" wide ticket with all header parameters left aligned. The Authorization Latitude, Longitude and Site Name will also appear on this default ticket.

Several MultiLoad devices can be attached to the same serial printer. Using the RS232 Multidrop hardware in the MultiLoad it is possible to connect the RS232 COM 2 port on all MultiLoad II devices to a single printer. Serial connections must be as follows:



The DTR signal from the printer should provide the printer status (busy, on-line, paper out, error, etc.) MultiLoad will monitor its CTS input to report any printer status errors.

When COM 2 is put into the Multi mode, the MultiLoad will monitor the RTS line to determine when the printer is in use by another MultiLoad II device. The DCD line on the MultiLoad will be driver low by a MultiLoad device to take control of the printer.

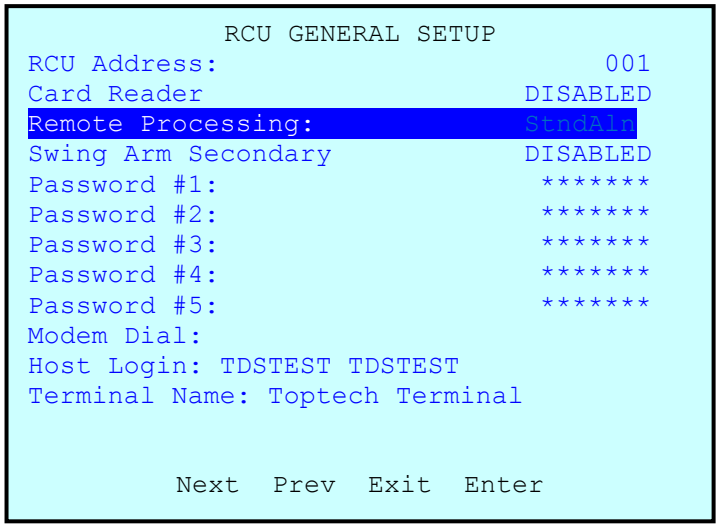
12.5.4 MISCELLANEOUS TASKS

Any power, signals, permissives, or lockouts that are not supplied or controlled by MultiLoad II directly will need to be bypassed or put into manual operation. For example, if a permissive to MultiLoad II or an additive pump or product pump is controlled by a PLC that receives commands from TMS rather than MultiLoad II, these pumps will not start automatically in Standalone mode because TMS and the PLC will not be aware of the status of the MultiLoad II (in standalone operation).

12.5.5 CONFIGURING MULTILOAD II FOR LOCAL MODE

If the MultiLoad II is configured to operate in Remote mode, that is, in conjunction with TMS, you need only change one configuration parameter to operate in standalone mode. Enter Program Mode, Configuration, RCU General Setup.

The RCU General Setup screen displays.



Select Remote Processing and press Enter. The ENABLED value changes to DISABLED, switching the MultiLoad II to Local, standalone mode.

12.5.6 OPERATION IN LOCAL MODE

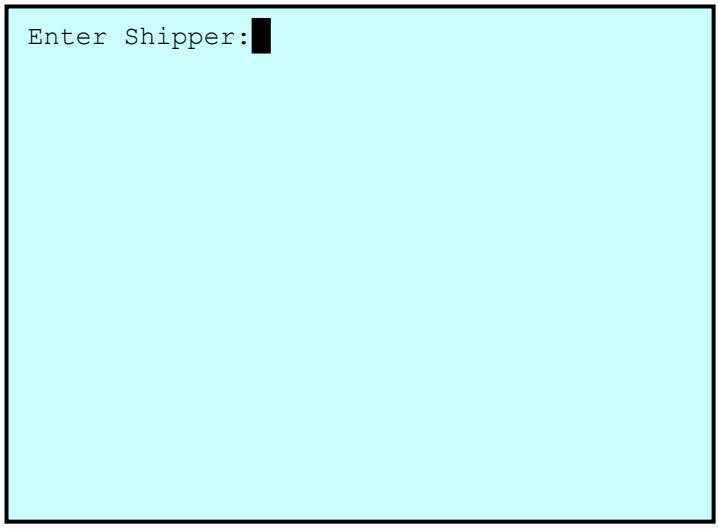
Operation in Local standalone mode is nearly identical to operation in Remote mode, with the following exception: In Local mode the driver must key in product owner and customer IDs on the screen prompts (previously set up with the Configuration tool). In other words, account picklists are not available in Local mode.

12.5.7 LOCAL AUTHORIZATION

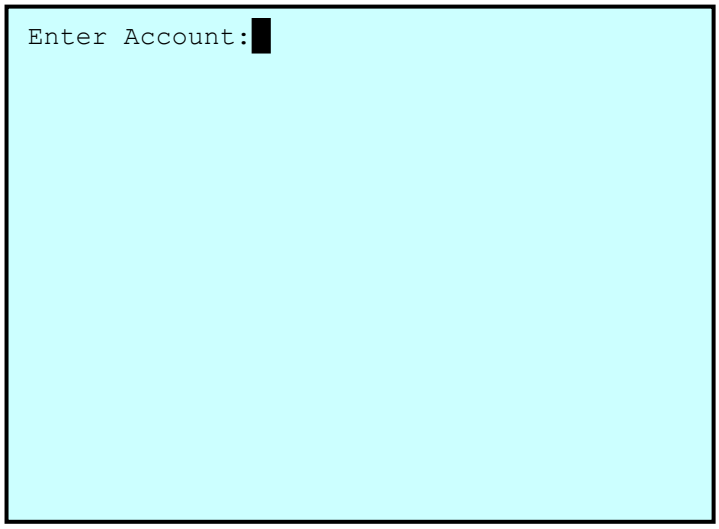
As mentioned earlier, in Local mode, the MultiLoad II prompts the driver to insert a driver card or enter an access ID/driver # and PIN. This PIN code must match the PIN code of the driver table stored in the MultiLoad II's non-volatile database. Once the PIN code is verified, the MultiLoad II acts upon an internal configuration regarding additional prompts.

The MultiLoad II has up to four configurable prompts that may be displayed to the driver. Once data has been entered for each of these prompts, MultiLoad II will authorize the load.

The configuration driver prompts are defined using the Miscellaneous function in the Configuration Tool. The driver will view only those prompts defined. For example, if you defined Prompt 1 to prompt the driver for the Shipper ID, the driver will be presented with the following screen.



When the driver keys in the Shipper ID and presses **Enter**, the second customized prompt appears:



The driver keys in the account number and presses **Enter**.

If these are the only prompts defined, the next screen the driver will view will be the Load Screen.

On MultiLoad II

```
PRE  PRODUCT        SET     DEL   STATUS
>1   Preset 001       0       0   IDLE
 2   Preset 002       0       0   IDLE




      Next  Prev  ExitLoad  Enter=Pick
```

On MultiLoad II SMP

```
          Preset 001
            IDLE
          PRESET:
                0
          DELIVER:
                0
          GALLONS
     ExitLoad Enter=Preset
```

From this point, operation is identical to operation in Remote mode. However, when the load completes and the driver pulls his card, instead of TMS printing a bill of lading, the MultiLoad II will print a Meter Ticket.

12.5.8 METER TICKET

If so configured, the MultiLoad II prints a meter ticket for the entire transaction.

12.5.9 SWITCHING BACK TO REMOTE MODE

To switch to Remote mode, enter program mode, select Configuration, RCU General Setup.

The RCU General Setup screen displays.

```
              RCU GENERAL SETUP
RCU Address:                          001
Card Reader                       DISABLED
Remote Processing:                StndAln
Swing Arm Secondary               DISABLED
Password #1:                      *******
Password #2:                      *******
Password #3:                      *******
Password #4:                      *******
Password #5:                      *******
Modem Dial:
Host Login: TDSTEST TDSTEST
Terminal Name: Toptech Terminal


           Next   Prev   Exit   Enter
```

Select Remote Processing and press Enter. The DISABLED value changes to ENABLED, switching the MultiLoad II to Remote mode.

12.6 AUTOMATIC PROVING FUNCTION

This feature is designed for flow meter proving that is performed by delivering a predetermined volume into a static, calibrated vessel. When a proving run is initiated, flow rates and delivery volumes can be selected and implemented, without entering the program mode and changing the flow profile that is used for day-to-day operations.

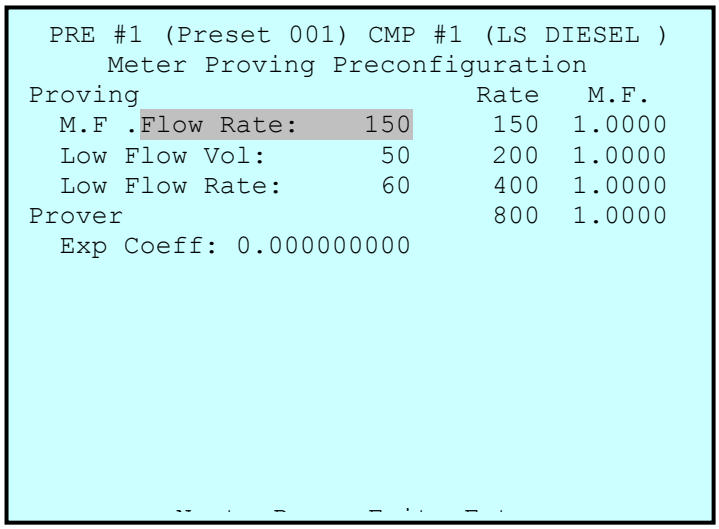
When delivery is complete, the prover operator will be prompted to enter the volume that was observed in the calibrated vessel. A new meter factor for that proving flow rate will be calculated and entered into the MultiLoad II configuration, if approved by the operator.

Determine the Number of Proving Flow Rates- The number of flow rates that will be proven should be established during the initial MultiLoad II installation. Determine how many flow rates will be proven. In the program mode, enter the Weights and Measures menu and select Components. Scroll through the menu and select the parameter entitled # Meter Factors Used. Enter the number of flow rates that will be used to prove the meter for the selected component. Valid choices are 1-4.

Establishing Meter Factor Flow Rates- Enter the rates that will be proven. In Program mode, enter the Weights and Measures menu and select Components. Scroll through the menu and select Meter Factor #1 Rate. Enter the first proving flow rate. If proving will be done for two flow rates, enter the second flow rate in Meter Factor #2 Rate field. Up to four proving rates may be entered.

12.6.1 USING THE PROVING FEATURE

1. Activate the Weights and Measures switch.
   In stand-alone mode, Navigate to Program Mode->Configuration->RCU Setup and enable the Meter Proving Mode parameter.
   In remote mode, the host system must send a “MPT” (Meter Proving Transaction) command to the Multiload.
2. Authorize a single product transaction on the MultiLoad II. (Cannot be a blend).
3. Press enter and preset the volume that is to be delivered into the test vessel.
4. Press Enter to authorize the preset quantity.
5. Following Authorization, the operator will advance to the Meter Proving pre-configuration screen. At this screen, the Flow Rate field will be highlighted.



(Note: The Weights and Measures Switch MUST be active to modify Rate and M.F. parameters).

6. Press Enter to scroll through the proving flow rates. These flow rates were established during the Preliminary Setup. Press **Next** after finding the desired flow rate.

	Note: If the flow rates are no longer appropriate, they can be changed by following the procedures that follow.

7. At the Low Flow Volume field, press **Enter** to key in the volume to be delivered at the Low Flow Rate. Press **Next** to advance to the following field.
8. At the Low Flow Rate field, press **Enter** to key in the flow rate. Press **Next** to advance to the following field.
9. At the Expansion Coefficient field, press Enter to key in the expansion coefficient of the proving container. (Use the table below for values.) If the value is unknown, leave the value set to zero. Press the **Next** button to advance to the Rate field.

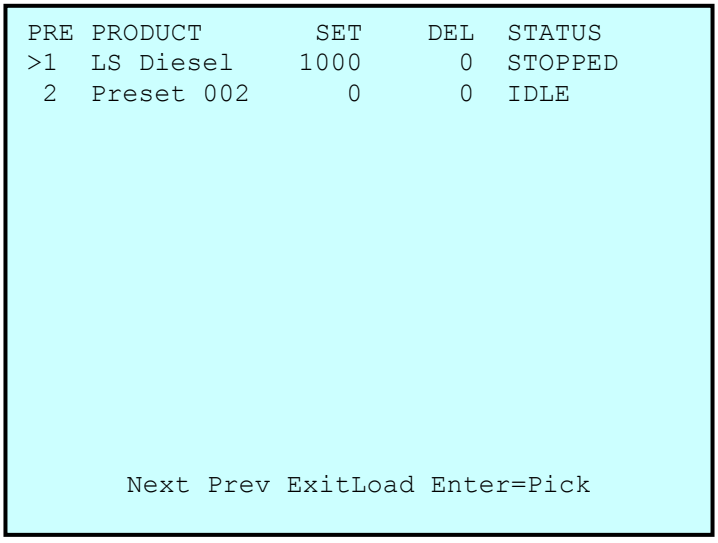
Prover Material	*Coefficient of Expansion*
Stainless (Seraphin)	*0.00004770/°C*
Stainless (Seraphin)	*0.00002650/°F*
304 SS	*0.00005184/°C*
304 SS	*0.00002880/°F*
316 SS	*0.00004536/°C*
316 SS	*0.00002520/°F*

10. Under the Rate heading are the flow rates that have been established for proving. If the rates are no longer appropriate, they can be changed at this field. Press Enter to change the proving Flow Rate or press the Next button to advance to the rate's meter factor (MF) field. If it is necessary to change the rate, the corresponding meter factor (MF) should be changed to 1.0000.

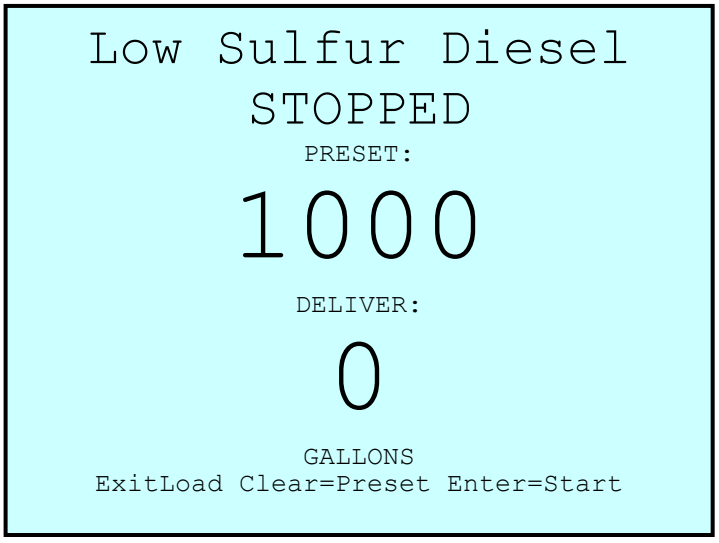
	If a rate and/or Meter Factor (MF) has been changed, it will be necessary to return to the Flow Rate field and select the new rate. Use the Prev key to return to the Flow Rate field. Press Enter until the new rate appears. Continue with the following step.

11. The MF field shows the current meter factor for the flow rate that is posted to the left of the field. This should not be changed by the user at this point, unless a new flow rate is going to be used, as described in the previous step.
12. Pressing the Next button will advance the user to the remaining rates and meter factors. To return to any of the previous fields, press the Prev key.

On MultiLoad II



On MultiLoad II SMP



13. When the meter proving pre-configuration is complete, press Exit to advance to the Preset Control Screen.

14. Press Enter to commence the proving run. When the Enter key is pressed, the Preset Status Screen will appear.

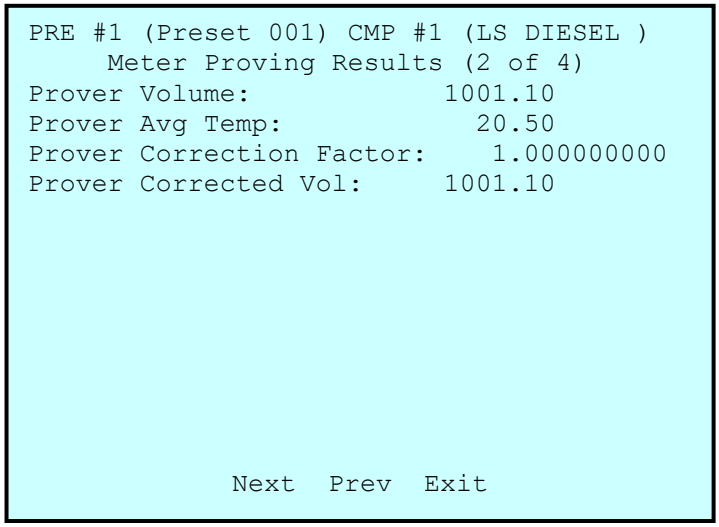
```
          PRESET 01 STATUS SCREEN
PRODUCT:  Low Sulfur Diesel
STATUS:   LOW FLOW
                GROSS       NET
     PRESET:     1000
     REMAIN:      996
     DELIVER:       3.90      3.90
     TOTAL:         4

          TEMPERATURE:  24.00C
          PRESSURE:      0.00
          DENSITY:        0.0
          BSW:           0.00
          FLOW RATE:       59

            Next Prev Exit Stop
```

15. When the preset quantity has been delivered, press Next to advance to Meter Proving Results screen

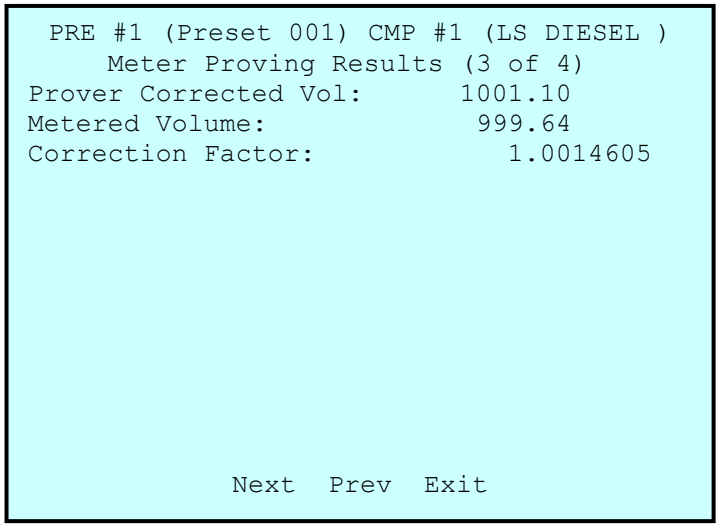
```
 PRE #1 (Preset 001) CMP #1 (LS DIESEL )
    Meter Proving Results (1 of 4)
Prover Volume:             1001.10
Prover Temperature #1:       20.00
Prover Temperature #2:       21.00
Prover Temperature #3:
Prover Temperature #4:









          Next  Prev  Exit  Enter
```

16. The Prover Volume field should be highlighted. Press Enter and key in the volume observed in the proving vessel.
17. Press Next to advance to the Prover Temp #1 field. If prover temperature readings are available, press Enter and key in the temperature observed at the first prover thermometer. Press Next to advance to the next temperature field.

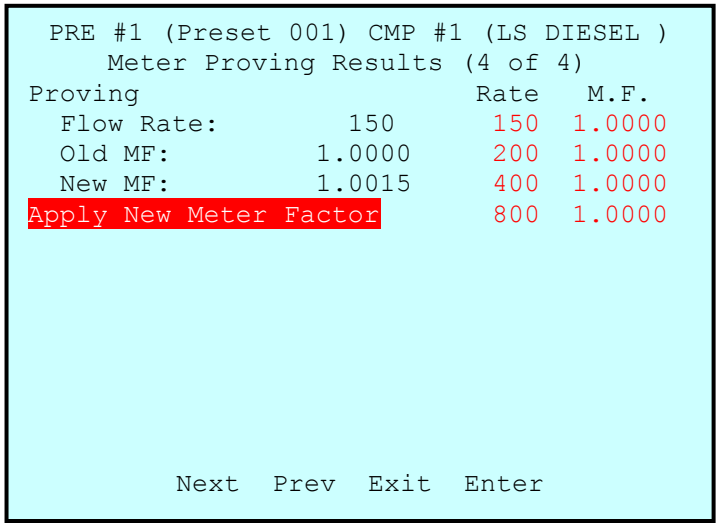
18. Enter temperatures as described in the previous step. When finished entering temperatures, press the Next key to advance to the Meter Proving Results screen #2. If no temperatures will be entered, press the Next key until the Meter Proving Results screen #2 appears.


PRE #1 (Preset 001) CMP #1 (LS DIESEL)
Meter Proving Results (2 of 4)
Prover Volume: 1001.10
Prover Avg Temp: 20.50
Prover Correction Factor: 1.000000000
Prover Corrected Vol: 1001.10
Next Prev Exit

19. The Meter Proving Results screen presents the following data entered by the operator: Observed volume, the average of the proving temperatures and the Prover Correction Factor. From these data, the Prover Corrected Volume is calculated and displayed. No entries are to be made at this screen. Press the Next key to advance to the Meter Proving Results screen #3.


PRE #1 (Preset 001) CMP #1 (LS DIESEL)
Meter Proving Results (3 of 4)
Prover Corrected Vol: 1001.10
Metered Volume: 999.64
Correction Factor: 1.0014605
Next Prev Exit

20. Meter Proving Results screen #3 displays the Prover Corrected Volume, the Metered Volume and the Correction Factor that was calculated from all of the data that was entered by the operator. No entries are to be made at this screen. Press the Next key to advance to the Meter Proving Results screen #4.



(Note: The Weights and Measures Switch MUST be active to modify Rate and M.F. parameters).

21. At the Meter Proving Results screen #4, the proving Flow Rate, Old Meter Factor and New Meter Factor will be displayed.

    a. To accept the New Meter Factor, press Enter. The New Meter Factor will automatically be programmed into the system for the appropriate proving rate. After accepting the New Meter Factor, press Exit to return to the Preset Control screen. If another proving run is to be performed, clear the preset and re-select a product. Repeat the process, beginning from step #4. Pressing the next key will also allow manual modification of the MF and Rates.

    b. If the proving run is to be aborted, press Exit. The Old Meter Factor will remain in effect. Pressing Exit at this screen will return the operator to the Preset Control screen. At the Preset Control screen, the batch can be cleared and another proving run can be initiated.

22. When all proving has been completed, press Exit twice to end the transaction.

CHAPTER 13 CUSTOM LOGIC

13.1 OVERVIEW

Custom Logic supplements the standard logic in MultiLoad II. This allows the MultiLoad II to perform many of the simple I/O sequencing tasks that would have required an additional PLC.

Configuring Custom Logic involves the building a list of logic instructions to read FCM inputs, read MultiLoad II internal states (bay authorized, batch authorized, pump run, etc.), perform logic operations (logic AND, OR, etc.) and control FCM outputs.

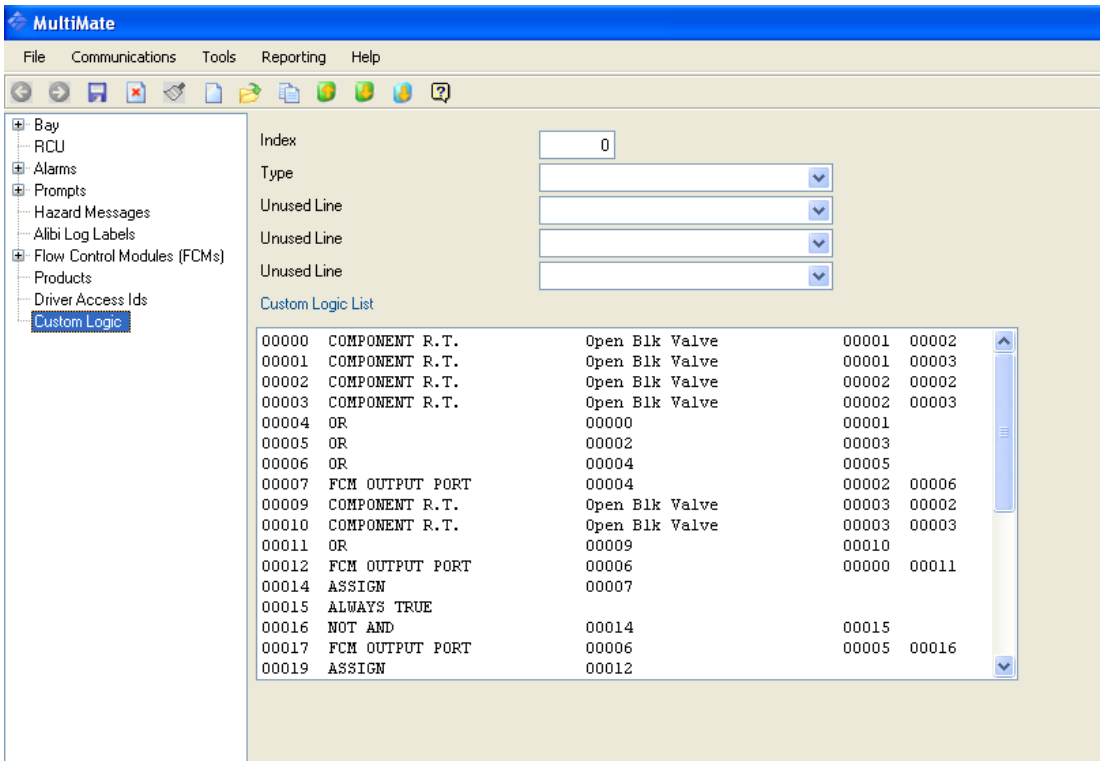
13.2 MULTILOAD II ACCESS TO CUSTOM LOGIC

To access the Custom Configuration from the MultiLoad II keypad, enter the program mode, select Configuration, then Custom Logic. The Custom Logic screen displays.

```
                CUSTOM LOGIC
[0000] UNUSED
[0001] UNUSED
[0002] UNUSED
[0003] UNUSED
[0004] UNUSED
[0005] UNUSED
[0006] UNUSED
[0007] UNUSED
[0008] UNUSED
[0009] UNUSED
[0010] UNUSED
[0011] UNUSED
[0012] UNUSED
[0013] UNUSED
          Next  Prev  Exit  Enter
```

13.3 MULTILOAD II CONFIG TOOL ACCESS TO CUSTOM LOGIC

Using the MultiLoad II configuration utility, Custom Logic can be found under the Miscellaneous heading.

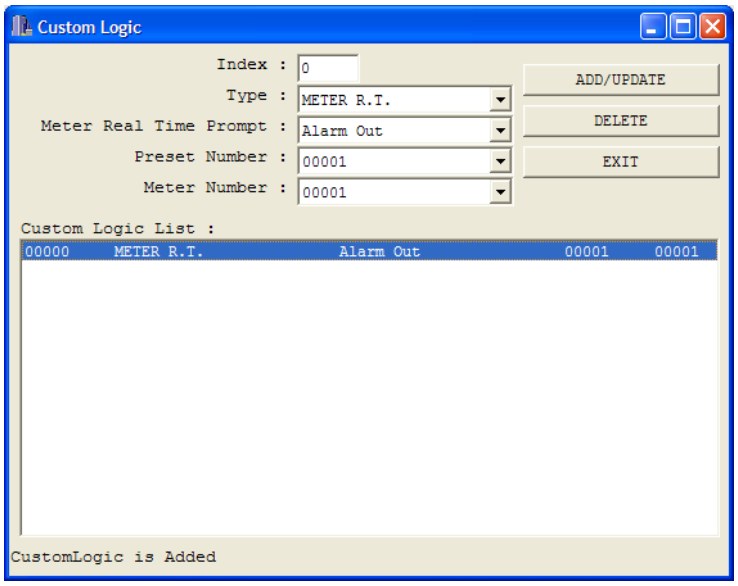


13.4 WRITING CUSTOM LOGIC

Each line of the Custom Logic routine is created using some or all of the five fields in the Custom Logic screen. The Index and Type fields are always used. Three fields that follow the Type field are determined by the function selected in the Type field.

To create a line of Custom Logic, enter an Index number in the Index field. The first line shall be entered as 000. Next, select a function from the Type field. The functions will either be standard MultiLoad II functions or Boolean operations.

After a Type function is selected, the three fields that follow it will be defined. When a line of Custom Logic is completed, it is added to the Custom Logic List when the Add/Update button is selected.



INDEX: This field numbers each line of logic. When creating the first line, use index 000 and number subsequent lines sequentially.

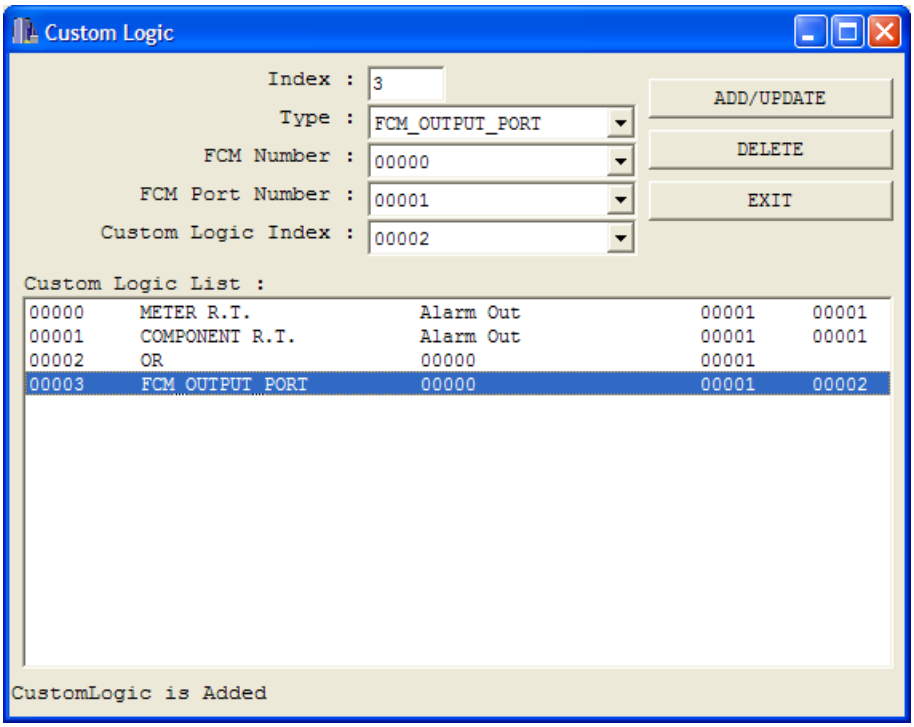
TYPE: There are two classes of items to select for this field: The item selected will be a MultiLoad II function, such as an Alarm Output, or a Boolean operation. MultiLoad II operations are defined as Real Time (RT) and the Boolean operations are identified by specific mathematical or logic operations, such as Add, Subtract, NOR, AND, etc.

REAL TIME: The MultiLoad II Real Time (RT) operations represent existing MultiLoad II functions. Functions are assigned to various MultiLoad II hierarchal levels: RCU, Bay, Preset, Meter, Component and Additive. After a Real Time function is selected, it will be necessary to specify the relevant Preset and a specific Meter, Component or Additive.

The above example is using the Alarm Out function. This particular function is defined at the Meter level in MultiLoad II: Whenever an alarm related to a specific meter is raised by MultiLoad II, an output can be activated. In this example, it is desired to take advantage of MultiLoad II's Alarm Out logic to make some decision, rather than activate an FCM output based on a meter-level Alarm Out condition.

A meter-level Real Time prompt called Alarm Out has been selected. After selecting this prompt, the programmer must indicate which Preset (load arm) is being referenced. In the example, Preset 1 is selected for Index 000. Because the Alarm Out function is meter-level, the Preset's specific Meter must be identified (SMP can only have 1 meter, so this will always be 1).

BOOLEAN OPERATION: When a Boolean operation, such as OR, is selected in the TYPE field, the operation will be applied to two lines in the Custom Logic List. The lines to which this operation is directed can be specified in the two fields that follow the Type field. The following example shows how the operation is applied to Index 000 and Index 001.



In the above example, it is desired to activate a warning lamp anytime an alarm condition is raised the meter or component. The Alarm Outs from the meter and component are ORed so that when all arms are normal, a high voltage is available at the assigned output. When any one of the arms enters into an alarm condition, the high voltage output is dropped and the alarm warning lamp is illuminated.

The final line (Index 003) assigns an FCM output port to turn on or off, depending on the outcome of Index 002. The output is available at the internal I/O Board or external FCM, port 1 in this example.

Custom Logic selections for the TYPE field are listed below. There are currently 28 choices. Each choice may have a number of additional data fields to specify.

13.5 MULTILOAD II REAL TIME (RT) FUNCTIONS

1. Unused-Choose this selection to leave an index line blank.
2. FCM Input Port-Look to an FCM input port.
    a. FCM #-Specify FCM# (0 for I/O Board)
    b. FCM Input Port #-Specify FCM Port #
3. FCM Output Port-Activate an FCM Output.
    a. FCM #-Specify FCM# (0 for I/O Board)
    b. FCM Output Port #-Specify FCM Port #
    c. Custom Logic Index- The output will be activated depending on the state of the Index line referenced by this field.
4. RCU Real Time (RT)
    a. RCU Real Time Prompt-

i. Proving Mode-Indicates if the MultiLoad II is in the Proving Mode.
ii. W&M Key-Indicates if the W&M key is active
iii. Program Key- Indicates if the Program key is active
iv. Card Inserted- Indicates if a proximity card has been detected by the card reader.
v. Time- Indicates the time in hours and minutes of they day
vi. Date- Indicates the current year, monty an day (YYMMDD) of the Multiload

5. Bay Real Time (RT)
    a. Bay Real Time Prompt
        i. Clearing Errors-Indicates that operational alarms are being cleared. This process can be initiated remotely or locally.
        ii. Diagnostic Mode-Indicates when the operator has entered a diagnostic screen.
        iii. All Stop-Indicates when the ALL-Stop button has been pressed.
        iv. Alarm Out-Indicates when a Bay level alarm, such as a permissive, has been violated.
        v. Authorized-Indicates when a driver has successfully completed the authorization process and is cleared to load.
        vi. Permissive Out-Indicates that all Bay-Level permissives have been satisfied.
        vii. Permissive 0-7-Monitors state of permissives 0-7.
        viii. Deadman Input (to reset the deadman timer)
        ix. Deadman Output (to give the deadman pre-alarm)
        x. Deadman Bypass (To bypass the deadman functionality)
        xi. Total Volume (Volume deliverd by the full Bay)
6. Preset Time (RT)
    a. Preset Real Time Prompt
        i. Authorized-Indicates when a driver is authorized to use a particular preset (load arm).
        ii. Flow Active-Indicates when flow is active on a particular preset.
        iii. Batch Authorized-Indicates when TMS has reviewed preset quantity and product selection information and has authorized the batch for delivery.
        iv. Load Complete-Indicates when a batch has been completed on a particular load arm.
        v. Clearing Errors Indicates that operational alarms are being cleared on a particular preset. This process can be initiated remotely or locally.
        vi. Clearing Load-Indicates that the batch has been archived on a particular preset. A driver clears a batch by pressing the CLR button before selecting the next product to load or by pulling the cared to end the entire transaction.
        vii. Open Block Valve-Indicates that a preset-level Block Valve has been commanded to open.
        viii. Block Valve Status-Indicates that a preset-level Block Valve status has been received.
        ix. Close Block Valve indicates that a preset-level Block Valve has been commanded to close.
        x. Remote Start-Indicates that the Remote Start button of a particular preset has been pressed.
        xi. Swing Arm-Indicates that the swing-arm of a particular preset is active (in the bay).
        xii. Meter Stop-Indicates that the Meter Stop button of a particular preset has been pressed.
        xiii. Alarm Out-Indicates that a preset-level alarm has is active.

xiv. Permissive-Indicates that a preset-level permissive is active.

xv. Permissive Out-Indicates that all preset-level permissives have been satisfied.

xvi. Preset State (High Flow, Low Flow,….)

FST_IDLE = 0,

FST_LOW_FLOW = 1,

FST_HIGH_FLOW = 2,

FST_FIRST_TRIP = 3,

FST_SECOND_TRIP = 4,

FST_FINAL_TRIP = 5

xvii. Gross Deliverd Preset Quantity (value is in whole defined)

xviii. Net Delivered Preset Quantity (value is in whole defined)

xix. Mass Delivered Preset Quantity (value is in whole defined)

xx. Delivered Percentage (value is in hundreths defined meaning two number after the decimal point)

xxi. Remaining Volume (value is in whole defined)

xxii. Gross Flow Rate (value is in whole defined)

xxiii. Temperature (value is in hundreths defined meaning two numbers after the decimal point)

xxiv. Pressure (value is in hundreths defined meaning two numbers after the decimal point)

xxv. Density (value is in tenths defined meaning one number after the decimal point)

xxvi. Relative Density (value is in tenthousth defined meaning 4 numbers after the decimal point)

xxvii. Api Gravity (value is in tenths defined meaning one number after the decimal point)

xxviii. BSW (value is in hundreths defined meaning two numbers after the decimal point)

b. Preset Number- Specify the preset. (Always 1 on MultiLoad II SMP.)

7. Component Time (RT)

a. Component Real Time Prompt

i. Clearing Errors-Indicates that a component level alarm is clearing for a particular component.

ii. Clearing Batch-Indicates that a particular component is being cleared and archived.

iii. Pump Run-Indicates that a particular Component's pump has been commanded to run.

iv. Pump Kill-Indicates that a Pump Kill signal has been received for a particular component.

v. Pump Status-Indicates that a Pump Status signal has been satisfied for a particular component.

vi. Open Block Valve- Indicates that a Block Valve has been commanded to open for a particular component.

vii. Block Valve Status-Indicates that a component-level Block Valve status has been received from a particular component.

viii. Close Block Valve- Indicates that a Block Valve has been commanded to close for a particular component.

ix. Alarm Out-Indicates that a component-level alarm, such as Block Valve Status, is active for a particular component.

x. Authorized-Indicates when a driver is authorized to use a particular component.

xi. Permissive- Indicates that a component-level permissive is active.
xii. Permissive Out-Indicates that all component-level permissives have been satisfied.
xiii. Comp State(High Flow, Low Flow,…..)

FST_IDLE = 0,
FST_LOW_FLOW = 1,
FST_HIGH_FLOW = 2,
FST_FIRST_TRIP = 3,
FST_SECOND_TRIP = 4,
FST_FINAL_TRIP = 5

xiv. Gross Deliverd Preset Quantity (value is in whole defined)
xv. Net Delivered Preset Quantity (value is in whole defined)
xvi. Mass Delivered Preset Quantity (value is in whole defined)
xvii. Gross Flow Rate (value is in whole defined)
xviii. Temperature (value is in hundreths defined meaning two numbers after the decimal point)
xix. Pressure (value is in hundreths defined meaning two numbers after the decimal point)
xx. Density (value is in tenths defined meaning one number after the decimal point)
xxi. Relative Density (value is in tenthousth defined meaning 4 numbers after the decimal point)
xxii. Api Gravity (value is in tenths defined meaning one number after the decimal point)
xxiii. BSW (value is in hundreths defined meaning two numbers after the decimal point)

b. Preset Number- Specify the preset. (Always 1 on MultiLoad II SMP.)
c. Component Number- Specify the component. (Always 1 on MultiLoad II SMP.)

8. Meter Real Time (RT)
   a. Meter Real Time Prompt
      i. Clearing Errors-Indicates that a meter-level alarm is clearing for a particular flow meter.
      ii. Clearing Totals-Indicates that batch totals are clearing for a particular flow meter.
      iii. Alarm Out -Indicates that a meter-level alarm, such as Low Flow, is active.
      iv. Authorized-Indicates that a particular flow meter is authorized for use.
      v. Permissive-Indicates that a meter-level permissive is active.
      vi. Permissive Out-Indicates that all meter-level permissives have been satisfied.
      vii. Side-Stream on meter-Indicates that a particular flow meter is a side-stream meter and that it is authorized for the batch.
      viii. Meter Sate (High Flow, Low Flow, …)

FST_IDLE = 0,
FST_LOW_FLOW = 1,
FST_HIGH_FLOW = 2,
FST_FIRST_TRIP = 3,
FST_SECOND_TRIP = 4,

FST_FINAL_TRIP = 5

ix. Gross Deliverd Preset Quantity (value is in whole defined)

x. Gross Flow Rate (value is in whole defined)

xi. Temperature (value is in hundreths defined meaning two numbers after the decimal point)

xii. Pressure (value is in hundreths defined meaning two numbers after the decimal point)

xiii. Density (value is in tenths defined meaning one number after the decimal point)

xiv. Relative Density (value is in tenthousth defined meaning 4 numbers after the decimal point)

xv. Api Gravity (value is in tenths defined meaning one number after the decimal point)

xvi. BSW (value is in hundreths defined meaning two numbers after the decimal point)

xvii. Creep Gross Volume (value is in whole defined)

b. Preset Number- Specify the preset. (Always 1 on MultiLoad II SMP.)

c. Meter Number- Specify the meter. (Always 1 on MultiLoad II SMP.)

9. Additive Real Time (RT)

a. Additive Real Time Prompts

i. Clearing Errors-Indicates that an additive-level alarm is clearing for a particular additive.

ii. Clearing Batch-Indicates that additive totals of a particular injector are being archived.

iii. Test Button-Indicates that the Test Button used in injector calibration has been pressed for a particular injector.

iv. Pump Run-Indicates that a particular Additive's pump has been commanded to run.

v. Pump Kill-Indicates that a Pump Kill signal has been received for a particular additive.

vi. Pump Status-Indicates that a Pump Status signal has been satisfied for a particular additive.

vii. Open Block Valve- Indicates that a Block Valve has been commanded to open for a particular additive.

viii. Block Valve Status- Indicates that a additive-level Block Valve status has been received from a particular additive.

ix. Flush Pump Run-Indicates that a particular additive's Flush Pump has been commanded to run.

x. Close Block Valve- Indicates that a Block Valve has been commanded to close for a particular additive.

xi. Alarm Out-Indicates that an additive-level alarm, such as Injector Fault, is active for a particular additive.

xii. Authorized-Indicates when a driver is authorized to use a particular additive.

xiii. Permissive- Indicates that an additive-level permissive has been received.

xiv. Permissive Out-Indicates that all additive-level permissives have been satisfied.

xv. Gross Delivered (value is in whole defined)

xvi. Additive Percentage (value is in hundreths defined meaning two number after the decimal point)

b. Preset Number- Specify the preset. (Always 1 on MultiLoad II SMP.)

c. Additive Number- Specify the Additive.

13.6 LOGIC FUNCTIONS

1. Always False
2. Always True
3. Assign
    a. Custom Logic Index
4. Not
    a. Custom Logic Index
5. AND
    a. Custom Logic Index
    b. Custom Logic Index
6. NAND
    a. Custom Logic Index
    b. Custom Logic Index
7. OR
    a. Custom Logic Index
    b. Custom Logic Index
8. NOR
    a. Custom Logic Index
    b. Custom Logic Index
9. EOR
    a. Custom Logic Index
    b. Custom Logic Index
10. ADD
    a. Custom Logic Index
    b. Custom Logic Index
11. SUBTRACT
    a. Custom Logic Index
    b. Custom Logic Index
12. MULTIPLY
    a. Custom Logic Index
    b. Custom Logic Index
13. DIVIDE
    a. Custom Logic Index
    b. Custom Logic Index
14. SET VALUE
    a. Value
15. EQUAL
    a. Custom Logic Index
    b. Custom Logic Index
16. LESS THAN
    a. Custom Logic Index
    b. Custom Logic Index
17. GREATER THAN
    a. Custom Logic Index
    b. Custom Logic Index
18. LESS THAN OR EQUAL
    a. Custom Logic Index
    b. Custom Logic Index
19. GREATER THAN OR EQUAL
    a. Custom Logic Index
    b. Custom Logic Index
20. START DELAY
    a. Custom Logic Index
    b. Custom Logic Index
21. STOP DELAY
    a. Custom Logic Index
    b. Custom Logic Index
22. BEACON (Continues Pulse)
    a. Custom Logic Index (On time)
    b. Custom Logic Index (Off time)
23. PULSE (Single Pulse)
    a. Custom Logic Index (On time of the Pulse)
    b. Custom Logic Index (Trigger for the Pulse)

CHAPTER 14 WEB INTERFACE

14.1 OVERVIEW

The Multiload2 has now a web-interface which gives following information:

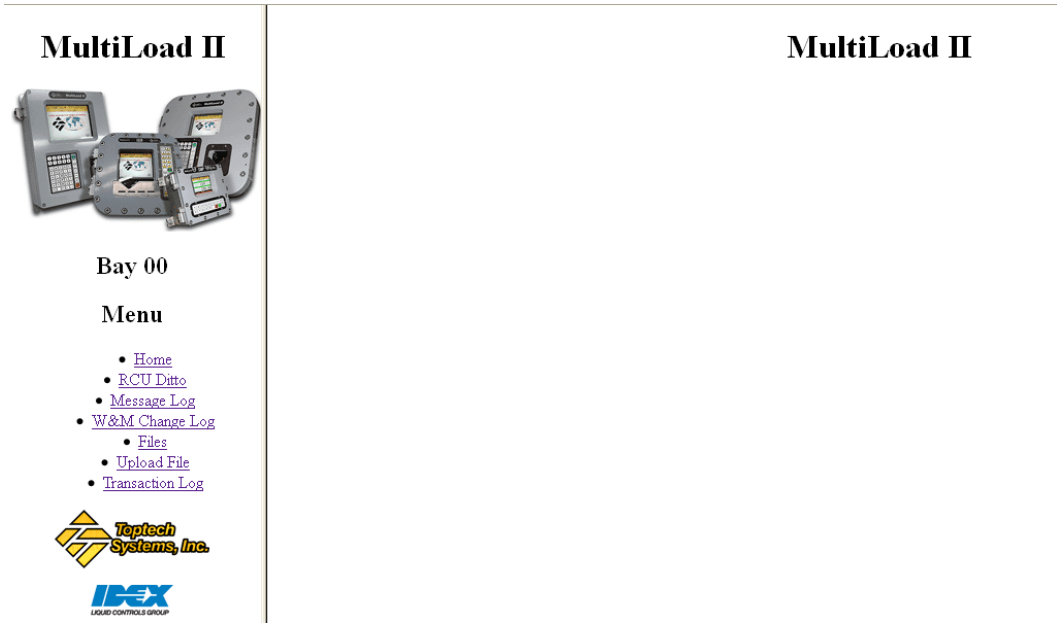
- Rcu Ditto (View of the display in the field)
- Message Log (Normal Logging of the Multiload2)
- W&M Change Log (W&M Log for parameter that are changed)
- Files(It is possible to see all files on the SD-Card and it is also possible to download all files)
- Upload File (It is possible to upload files or firmware remote to the device)

14.2 LOGIN

When going to the IP-address of the device a password Protected Login Screen will appear

14.3 WEBSITE

Home website of the Multiload2

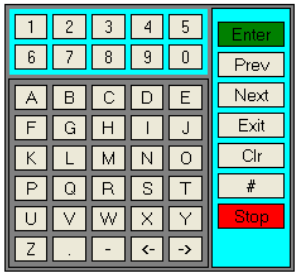


When open the rcuditto webserver it is possible to view what the driver is doing and also it is possible to you the remote keypad to interfere with the driver.

Note: Only when the user is logging with the admin user the keypad is available.

RCU Ditto

For Access
Press Next to Begin



14.4 MESSAGE LOG

Shows the full logging of every event on the Multiload2.

13/05/04 10:52:14 Card in successful for driver no. 00000111
13/05/04 10:52:16 PROMPT_CUSTOM_1 User input: 54321
13/05/04 10:52:17 PROMPT_CUSTOM_2 User input: 09876
13/05/04 10:52:19 PROMPT_CUSTOM_3 User input: JIHGF
13/05/04 10:52:21 PROMPT_CUSTOM_4 User input: JIHGF
13/05/04 10:52:23 PROMPT_CUSTOM_5 User input: JIHF
13/05/04 10:52:23 Transaction Stand-Alone Authorized for 00000111
13/05/04 10:53:28 Network port 7734 select() 60 second timeout.
13/05/04 10:53:28 Network port 7734 closed from 10.54.49.200:3849
13/05/04 11:37:53 Preset 1, Batch Cleared
13/05/04 11:37:53 Transaction Cancelled
13/05/04 11:37:57 PROGRAM MODE ENTERED
13/05/04 12:33:32 MultiLoad II v4.31.11 May 4 2013
Page 25 of 25. First Prev Next Last 25 50 100

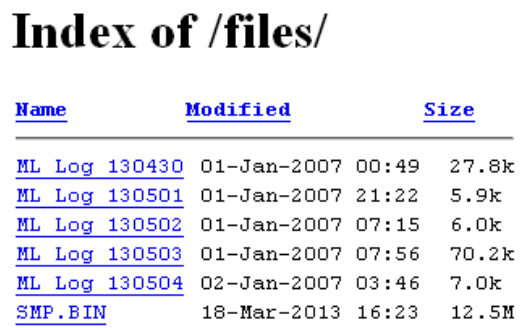
14.5 W&M CHANGE LOG

Shows the full W&M logging of every W&M parameter change in Multiload2.

```
#:00017 13/04/30 17:11 Id:C Database Level: 05 Set Factory Defaults
#:00018 13/04/30 17:42 Id:1Simulation Mode DISABLD->ENABLED
#:00019 13/04/30 17:51 Id:1Simulation Mode ENABLED->DISABLD
#:00020 13/05/01 14:25 Id:C Firmware Update 4.01.01-> 4.01.01
#:00021 13/05/01 14:25 Id:1Pre:01 Cmp:01 API Table None ->Invalid
#:00022 13/05/02 09:32 Id:C Firmware Update 4.01.01-> 4.01.01
#:00023 13/05/03 08:51 Id:C Firmware Update 4.01.01-> 4.01.01
#:00024 13/05/03 09:41 Id:1Pre:01 Cmp:01 API Table Invalid->None
#:00025 13/05/03 13:46 Id:C Database Level: 01 Set Factory Defaults
#:00026 13/05/03 13:46 Id:C Database Level: 05 Set Factory Defaults
#:00027 13/05/04 10:41 Id:C Firmware Update 4.01.01-> 4.01.01
Page 2 of 2. First Prev Next Last 25 50 100
```

14.6 FILES ON THE SD-CARD

It is possible to see all the files on the SD-Card remotely.



Index of /files/

Name	Modified	Size
ML Log 130430	01-Jan-2007 00:49	27.8k
ML Log 130501	01-Jan-2007 21:22	5.9k
ML Log 130502	01-Jan-2007 07:15	6.0k
ML Log 130503	01-Jan-2007 07:56	70.2k
ML Log 130504	02-Jan-2007 03:46	7.0k
SMP.BIN	18-Mar-2013 16:23	12.5M

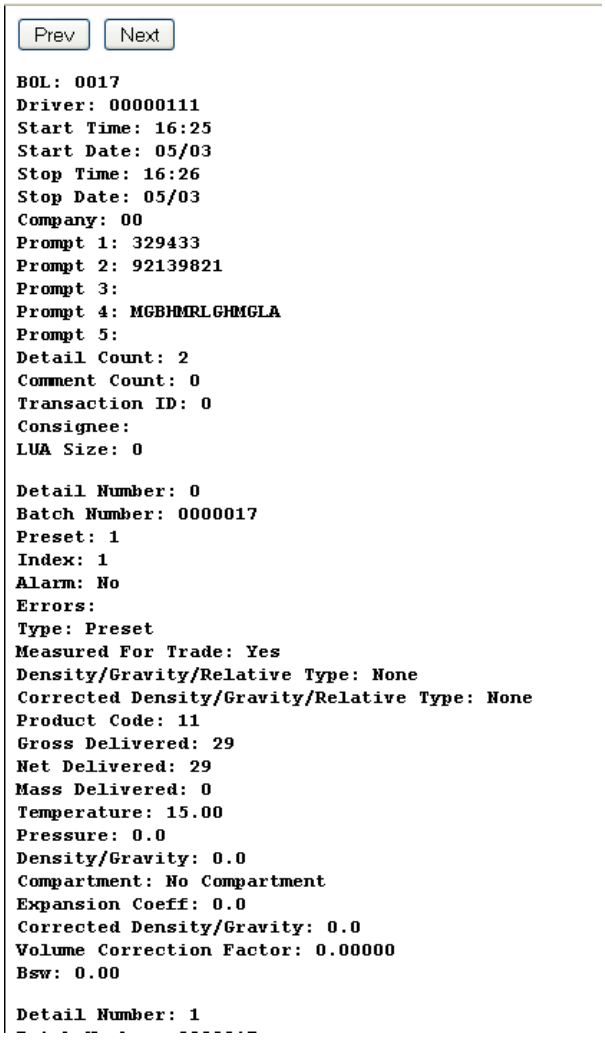
14.7 UPLOAD FILES TO THE SD-CARD

Upload files from a remote place to the Multiload is possible, even can be used to send the firmware file to the device.

14.8 TRANSACTION VIEWER

It is possible to see the last 10000 transactions in the web-interface of Multiload2.

Opening a transaction to get the full details of the load:



CHAPTER 15 FIRMWARE REVISION HISTORY

15.1 OVERVIEW

This revision summary is designed to assist in the determination of what changes have been made between different firmware builds and releases. Some comments may refer to internal testing, factory test/calibration routines, and simulator builds that may not affect typical MultiLoad users, but are still considered part of the firmware revision history.

15.2 FIRMWARE CHANGES

```
08/30/06 ML, ML1, SMP 3.26 WJP (released to QA and production)
  MultiLoad 1 Version 2.26 ported to MultiLoad II platform.
  Added customer logos.
  Added Kanji character sets.
  VGA (RCU) and QVGA (QRCU) support added.
  Ethernet support added.
  Support for FCMs with I/O board and 4-20ma functionality added.
  Added remote firmware upload (up to 16 MB).
  Added factory tests.

09/08/06 ML, ML1, SMP 3.26 WJP (released to QA and production)
  Added support for DIP, config(Program Mode) and W&M switches.
  Hardcoded legacy "all_stop" switch off.
  Removed legacy "all stop" configuration parameters.
  Added check to verify that the W&M switch is active before allowing firmware
flash update.
  Changed default Temp Module type from 0 (FCM 1 RTD) to 1 (FCM II and FCM I
Toptech module).

09/12/06 ML, ML1, SMP 3.26 WJP
  Updated Ethernet defaults to 192.168.0.200, 255.255.255.0, 192.168.0.1,
192.168.0.1 for factory tests.

09/18/06 ML, ML1, SMP 3.26 WJP (released to QA and production)
  Corrected bug in keypad driver that could cause application code to lockup.
  Increased ml_terminal protocol buffer size from 655 to 2048 characters for
processing longer messages.
  Added ability to upload a new firmware image with various packet sizes.

09/22/06 ML, ML1, SMP 3.26 WJP
  Corrected font size on Meter Proving Screens for SMP.

11/02/06 ML, ML1, SMP 3.26 WJP
  Added Factory Menu for use in testing.
  Added reboot support inside factory test functional.
  Added ML, ML1 and SMP product logos and updated display logic to alternate
between product logo and customer logo.
  Set default logo display to 1st graphic (Toptech globe).
  Fixed bug in Serial Port Test routine to restore the previous port parameter when
exiting the test.
  Added a factory I/O board calibration screen.
  Updated flash routines to keep interrupts enabled during flash programming.
  Added additive calibration logic to prevent block valve from opening unless
injector is shared.
```

```
  Added a flush volume reset after calibration to prevent flush alarm.
  Updated clock setup to show time/date in real time.

11/03/06 ML, ML1, SMP 3.26 WJP
  Added interface to use 4-20mA input on I/O Board or FCM II for Pressure and
Density Inputs.
  Added screensaver backlight control logic to dim backlight when idle.
  Added a new parameter, R046-screensaver_seconds with a default of 10 minutes.
  Added a new parameter, R047-screensaver_brightness_pct with a default of 50.00%.

11/06/06 ML, ML1, SMP 3.26 WJP (released to production)

11/17/06 2.27 WJP
  CAR #226 - Add service to background tasks in close_transaction_header to allow
COM and prevent the WDT from causing a reboot while processing transactions with a
very large number of details (>100).

11/21/06 2.27 WJP (released)
  CAR #233 - Force all “unused”/”future use” parameters to zero, and log when a
parameter change occurs.
  CAR #234 - Correct time edit position on the screen.

11/29/06 2.27 WJP (released to measurement Canada)
  (Req. of Measurement Canada) Added vapor pressure to component status display.
  (Req. of Measurement Canada) Added bay configuration parameter "Canada API
Limits" to extend low temps down to -40C on tables 54A, 54B (54BC removed), 54C,
54D.
  Corrected bug in conversion from 4-20ma to pressure or temperature that caused
value to loop around.
  (Req. of Measurement Canada) Limit 4-20mA pressure input to 0 to 4000 Kpa/PSI,
instead of the 9999.
  Extend pressure offset from +/- 3.00 to +/- 30.00 Kpa/PSI.
  (Req. of Measurement Canada) Changed the stand alone BOL to include "(Net) Volume
corrected to Vapour Pressure 15C" instead of "Net values corrected to 15C".
  (Req. of Measurement Canada) Changed the preset control screen to include
"GALLONS Volume corrected to 60 F" instead of "GALLONS corrected to 60 F".
  Fixed bug with uninitialized new_hazidx in ticket printing routine that caused
application to halt.

01/05/07 WJP
  Changed SMP normal fonts from 20 col to 40 col.  This includes all stand alone
prompting as well as host driven prompts.

01/18/07 WJP
  Added component_current_temp_hunds, component_current_press_hunds and
component_current_density_tenths to real time structure.

01/18/07 3.27.01 WJP
  Added minor version number to firmware version. xx.yy.zz
  Updated boot screen to display minor version number and firmware build date.
  Added UTF-8 terminal support.
  Updated R000 to include minor version number.
  Updated ditto register to return utf8 characters if displayed.
  Extend picklist register to handle UTF8 characters.
  Added Unicode diagnostic screen to view available CJK characters.
  Updated firmware version to 3.27.01

02/01/07 3.27.02 WJP
```

```
  Program Mode key switch no longer enables displaying 1/100s vol.
  Added RCU Setup parameter to enable or disable displaying 1/100s vol.
  W&M key switch no longer automatically enters proving mode when in standalone
mode.
  Added RCU parameter to enable or disable automatic proving mode when in stand
alone mode.
  When in proving mode, 1/100s vol are still displayed.
  Proving mode can be entered when W&M key not active, but parameter changes cannot
be made.
  Added component_current_temp_hund, component_current_pressure_hund and
component_current_density_tenths options to the MRS command.
  Corrected bug of unassigned meter variable that caused component status screen to
lockup SMP.
  Display current_temperature instead of batch temperature on component status
screen.
  Updated firmware version to 3.27.02

02/05/07 3.27.03 WJP
  Moved density sensor configuration from component level to meter level for meter
mass calculations.
  Kept optional default density at the component level.  Any non-zero value
overrides value from meter level.
  Removed "density_error" from component level alarms.
  Replaced the obsolete "fcm_permissive" with "density_alarm" in the meter level
alarms.
  Removed the unused meter level calculation of "gross_remain_hund".
  Updated ctl_densitygravity() to return batch_density when no API table selected.
  Updated the weighted temperature/pressure/density routine to provide more
accuracy (less rounding).
  Slowed down the FCM polling from open loop to 4 polls per second.
  Updated transaction to always record the density in the transaction.
  Updated PTB alibi transaction log logic to correctly record symbol for
PTB_APPROVED_SPECIFICATION when density_sensor is disabled, OR an overriding
density is specified at the component level configuration.
  Added meter level configuration "pulse_in_mass" to enable the conversion of meter
level mass pulses to component level volume.
  Added MSS command for SMP, similar to the MRS command but only returns 1
component instead of 8, 1 meter instead of 4, and 2 additives instead of 16.
  Added new query_3 value with bits to return meter level values
Meter_Batch_Gross_Del_Whole (Mass) and Meter_Gross_Flow_Rate (Mass Flow).
  Updated Preset Status Screen to Display Current Temperature/Pressure/Density when
flowing and Batch Temperature/Pressure/Density when stopped.
  Updated Component Status Screen to Display Current Temperature/Pressure/Density
when flowing or zero delivered and Batch Temperature/Pressure/Density when stopped.
  Included Component Status Screen on the Next/Prev Screen Loop.  Removed pressing
# on Component Screen to enter Component Status Screen. (In prep for keyless
program alarm clearing)
  Added Mass Section to the Component Status Screen showing Target, Delivered and
Rate when Pulses In Mass is configured.
  Updated Component Status Screen to always show Temperature/Pressure/Density.
  Moved Unicode Display from Factory Menu to Diagnostic Menu.
  Updated firmware version to 3.27.03.
  Updated database version to 3.27.03 for RCU Setup Database, Real Time Database,
and Equipment Database.
  Updated Makefile to build qml and qml1 images for use with QVGA displays.

03/02/07 3.27.04 WJP
```

```
  Added multilingual support all driver and program mode screens (except meter
calibration screens and MAC address configuration screen).
  Added "Driver Language", R008, and "Program Mode Language", R009, RCU level
parameters to select the language.
  Added the format type of 21 of "Language" type (0=English, 1=Spanish).
  Configuration parameter lengths have been increased from 20 to 30 characters.
  All levels of configuration screens are wider now to accommodate forign
languages.
  Configuration prompts will be returned in the language specified by "Program Mode
Language" parameter.
  Configuration parameters descriptions, ranges and defaults, as well as status and
key prompts have been moved into ROM.
  Updates to language prompt registers u000-099, u101xxx, u102xxx, u103xxx, u104xxx
no longer supported.
  Removed all configurable prompt registers, 700xxx, except ones used by TMS for
overseas customers (70000x-70004x, 70007x, 70019x, 70020x, 70028x, 70035x).
  Removed 701(status) and 705(additive status) label registers.
  Removed 720(key prompt) label registers.
  Alarm Label registers (R7100xx-R7140xx) will return the alarms in the language
specified by "Program Mode Language".
  Alarm Labels registers (U7100xx-U7140xx) will only update the labels on
permissives (U711001-711008, U712001, U712001, U713001, U714001).
  API tables 23E 'a', 59E 'b' have been added to support correction to 20C.
  Moved integer front end of API table 24E to a separate routine to allow 23E and
59E to access the 24E floating point calculations without rounding.
  Corrected Table 24E start point.  Correction did not effect 24E calculations.
  API tables can now return corrected_relative_density and corrected_density.
  Default configurable prompts are now disabled.
  Preset status and component status formatting has changed to accommodate forign
languages.
  Updated W&M change log to trace parameter index, and not memory index to
parameter, to handle ROM placement of parameters.
  Updated firmware version to 3.27.04.
  Updated database version to 3.27.04 for RCU Setup Database, Real Time Database,
and Equipment Database and W&M Log & Totalizer Database.

03/02/07 3.27.05 WJP (released to QA for testing)
  Marked parameters not releavent to the SMP builds to be NA.
  All NA parameters are reset to the default value on bootup.  A message is logged
when this occurs.
  Updated code so that writes to NA registers returns an invalid parameter code.
  Added "W&M Key FCM#" and "Program Key FCM#" as RCU level parameters for external
connection of W&M and program switches.  Status of these inputs are ORed with
internal inputs/DIP switches and can be viewed on the RCU Diagnostic screen.
  Incorporated final review of all Spanish Translactions.
  Added MultiLingual Product Graphic capability with English and Spanish versions
for the ML II, ML II 1-Arm, MultiLoad II SMP graphics.
  Corrected SMP bug when the program key was not active and the Load Screen Timeout
occurs, the screen would stop updating and keypad would stop functioning until a
end transaction signal was received.
  Updated firmware version to 3.27.05.
  Updated database version to 3.27.05 for Equipment Database.
  Per PEMEX, Calculation of CTL from Table 59E is calculated as CTL =
Measured_Density / Corrected Density from API Table 59E.

03/23/07 3.27.06 WJP (released to QA for testing)
  Corrected bug in transaction archive not recording the ending time.
```

```
  Corrected design in transaction archive that omitted storing the year in the
date.
  Removed unused datestr and timestr from RCU Setup Database.
  Removed unused Report Time, Detailed Report, and Auto Report from RCU Setup
Parameters.
  Marked the Preset Select Timeout RCU Setup Parameter as NA on SMP builds.
  Fixed bug where all RCU level NA parameters were logged as being reset to
defaults on every startup.
  Added debug precompiler directive label LOG_TERMINAL_CLEAN to assist with
capturing screen shots for manuals.
  Corrected bug that prevented the polling of the program and W&M switch when
system marked as not configured.
  Corrected bug that caused corruption of preset batch temp/pressure/density
values.
  Updated firmware version to 3.27.06.
  Updated database version to 3.27.06 for RCU Setup Database.

03/27/07 3.27.07 WJP (released to Pemex)
  Bug in 3.27.00-3.27.06 firmware checked Version instead of Product ID on firmware
uploads.  Added dummy version strings to firmware image to allow uploading by
3.27.00-2.27.06 firmware.
  Updated firmware version to 3.27.07.

04/05/07 3.27.08 WJP (released)
  Fixed bug in custom logic port selection screen where "Select..." was displayed
instead of "Port #x" in picklist.
  Updated firmware version to 3.27.08.

06/27/07 3.28.01 WJP (released to QA)
  Per Measurement Canada changed Side Stream Blending Logic as:
    Back calculation of main product stream component temperature is no longer
done.
    Blend meter temperature/pressure/density is passed back to the main product
stream component level.
    Blend meter temperature/pressure/density is passed up to preset level and side
stream temperature/pressure/density is not passed up to preset level.
    Blend meter volume is passed up to preset level and side stream volume is not
passed up to the preset level.
    API table listed for the main product stream is applied to the gross blend
meter volume and is passed up to the preset level.
    CR - Offloading Air Eliminator High Flow Control functionality.  Added two new
parameters "Alt. High Flow Rate" and "Alt. H.F. Rate FCM#" to change to an
alternate high flow rate when a status input changes.  This change is intended for
single product delivery without blending.
  Updated real time database version to 3.28.01.
  Updated firmware version to 3.28.01.

07/18/07 3.28.02 WJP (released to Measurement Canada)
  (Req. of Measurement Canada) Updated Ticket to include an "*" by any values not
measured for trade.
  Updated default stand alone ticket definitions to properly format ticket with
"*"s.
  Added preset and component status bit to indicate when "gross value measured for
trade".
    For Preset, when "gross value measured for trade" is not set, Temperature,
Pressure, Density, and Gross Volume may not be used for trade.  Net Volume may only
be used for trade when MultiLoad is applying an API table to convert gross to net
for all components.
```

For Component, when "gross value measured for trade" is not set, Temperature, Pressure, Density, Gross Volume and Net Volume may not be used for trade.
Updated firmware version to 3.28.02 (bug, still at 3.28.01).

07/23/07 3.28.02 (bug, still at 3.28.01) WJP (released to QA)
Corrected placement of Measured for Trade Flag in Transaction Database.
Updated transaction database version to 3.28.02.

08/06/07 3.28.02 WJP (released to QA)
Corrected firmware version from 3.28.01 to 3.28.02.

08/07/07 3.28.02 WJP (released to QA)
Corrected the retrieval of Gravity, Rel. Density, and Exp. Coeff at the preset level in MRS and transaction archive to use component with most volume delivered (value not directly measured and not valid for trade, no averaging done).

08/14/07 3.28.03 WJP (released to QA)
Updated dates to support 4 digit years per CR xxxx. Since hardware clock only supports two digit years, any year outside the range 2005-2099 will be displayed as zeros (0000). Printed tickets, Alibi Log, and Clock Setup Screens updated to display 4 digits.
Updated transaction archive database version to 3.28.03.
Updated firmware version to 3.28.03.

08/20/07 3.28.03 WJP (released to TTE)
Updated "MM/DD/YY Date:" parameter name.

10/16/07 3.28.04 GLP (released to QA)
Corrected bug in network socket RX task that did not close connection after a timeout. Explicit close from server is often not sent.
Updated firmware version to 3.28.04.

11/02/07 3.28.05 WJP (released to QA)
Incorporated the Portuguese Language.
Updated firmware version to 3.28.05.

11/26/07 3.28.05 WJP (released to QA)
Replaced "No" with "#" in Portuguese Language.
Added the ability to send serial messages from ethernet ports through the serial ports (Term Server).
Added communication type 5=Etherenet Passthrough Port to Register 091-093.
Added communication type "Ethernet" to the Communcation Setup Screen.
Added listing the COM0, COM1 and COM2 socket ports on the Network Setup Screen.
Removed checking on startup for the configuration of a host communication port.
Updated firmware version to 3.28.05.

11/27/07 3.28.06 GLP
Implemented alphanumeric data entry capability for the EXL keyboard.
Updated firmware version to 3.28.06.

01/09/08 3.28.07 WJP
Updated firmware version to 3.28.07.
Increased latest FCM version number from 17 to 34 for FCM II release.
Large Prompts parameter was added to the RCU setup.
Updated large prompt logic to only control prompts.
ECO2007-058
Increased the number of components in SMP builds from 1 to 8 to support multiple meter factors for ECO2007-58.

```
    Number of Components parameter added back into SMP builds.
  ECO2008-001
    Moved all flow rate parameters out of W&M control, except meter min and max
flow rates.  TMS can change these values when a batch is not authorized.
      Preset - Low Flow Rate
      Preset - High Flow Rate
      Preset - Alt. High Flow Rate
      Component - High Flow Rate
      Component - 1st Stage Trip Vol
      Component - 1st Stage Flow Rate
      Component - 2nd Stage Trip Vol
      Component - 2nd Stage Flow Rate
  ECO2008-002
    Added ability to lock down additive calibration data and recipe percentage
under W&M protection.  New parameters added.
      Additive - W&M Recipe Percentage
      Additive - W&M Additive Vol/Inject
      Additive - W&M Vol/Inject Cal Factr
      Additive - W&M Additive Mtr K-Factr
      Additive - W&M Additive Mtr Factor
  ECO2008-003
    Added the ability to connect an Alibi Log to a Serial Port.
      Added a communication port type of Alibi Log.
      RTS and DTS are always driven active.
      Data will only be transmitted when DCD, DSR and CTS signals are active.
      If DCD, DSR or CTS remain inactive for 5 seconds or more, a printer alarm
will be raised.
      Printer must be in hardware handshake mode, DTR used for pacing.
      Also added printer flow control and alarming to ticket printing.
  ECO2008-004
    Added interface to allow TMS to display other preset volumes, seperate from ML
values on the load screen.
      Values will be maintained in a different color to clearly establish them as
“not legally relevant” and should not be used for trade.
      Added new bay parameter "Number External Presets" to specify how many
external presets should be displayed.
      All external presets are displayed in a different color with a message
indicating "Not Legal for Trade".
      Added R/U401 register to update displayed external preset data.
      When an external preset is selected, the MultiLoad state will go to a 'a'-'h'
matching the preset number.
      MAMppp - can be sent by the host to return to the load screen when done
driving the screen.
  ECO2008-007
    Added ability to reprint any ticket or range of tickets from the transaction
archive.
    A serial port must be configured as connected to a printer.
    When viewing the header of a transaction in Views and Inquiries -> Transactions
a footer prompt of "1=Print Transaction" now appears instructing how to print the
transaction.
    After viewing two different transactions, a footer prompt of "2=Print
Transactions xxxx-yyyy" now appears instructing how to print the selected range of
transactions.
    Transactions that have been printed before, will be marked as Duplicates on the
ticket. (W&M requirement)
    Note: Per ECO2008-003, hardware handshake and alarming has also been added.
(W&M requirement).  This will require that customers properly wire the DTR and
```

```
other handshake signals to the RCU or a printer alarm will be raised and prevent
loading.

01/26/08 3.28.07 WJP (sent to QA for testing)
  Corrected bug that caused meter level alarms not to clear when leaving factory
calibration/analog calibration menu.

01/29/08 3.28.07 WJP (sent to QA for testing)
  Corrected bug that caused unknown RTD value on powerups and other errors.

03/13/08 2.28.07 WJP
  Corrected bug to properly handle and return negative API gravity. Updated
transaction retrival, MRS, and ticket printing.

03/17/08 3.28.08 WJP
  Corrected network RX task to properly handle abnormal socket terminations from
WINSOCK that return -1 from the socket read().
    Bug caused SMP/ML to lockup when a WINSOCK host application abnormally
terminated.
  Added ml_fcm2_tester binary output and functions to perform all digital and
analog FCM2 testing and calibration.
  Corrected display of 6 digit integers on the configuration screens (min/max
preset value).
  Added ability to use Temperature Module Type 3 to use 4-20mA on I/O Board or FCM
II Analog Board for Temperature Input.
  Updated firmware version to 3.28.08.

03/19/08 3.28.08 WJP (QA approved and released)
  Added Toptech 4-20mA status status line on the V&I -> View Temperature screen.

04/04/08 3.28.09 WJP (Beta Release to D.H. to solve field blend issue)
  Corrected signed/unsigned compares in ml_fcm_config.c causing blend to race out
of tolerance and alarm.

04/16/08 3.28.09 WJP (37 bit prox cards)
  Updated card reader code to support HID 37 bit H10320 formatted cards (facility
code = 0).

05/07/08 3.28.09 WJP
  Added Decal and Terquimsa customer logos for TTE.

06/03/08 3.28.09 WJP
  Corrected bug in limit checking 1st and 2nd trip flow rates that allowed negative
target rates to ramp up flow beyond excess rate.
  Corrected bug in computing lower BD rate that caused valve to "hunt" when lower
limit went negative.

06/22/08 3.28.10 WJP
  Added customer supplied TransMontaigne2 logo.
  Corrected bug in reading IP address information on the serial port.
  Moved the Date & Time setup from the W&M Menu to the Configuration Menu.  Changes
are still logged in the W&M change log.
  Updated FCM 2 tester code to use fast polling.
  Updated FCM 2 tester code to display DC power output status.
  Updated firmware version to 3.28.10.
```

```
06/26/08 3.28.10 WJP
  Fixed bug that caused the output pulse configuration to incorrectly reserve port
1 (on IO boards should be port 10) and raise a configuration alarm when anything
else was assigned to the port.
  Since output pulse can be on port 1 (fcm) or 10 (io board), and it is not known
what board is attached do not report output pulse assignment conflicts.

07/17/08 3.28.10 WJP
  Added ml_gps.c to build to support GPS operations.
  To support the building of a linux ML simulator task,
    Updated Makefile to build a linux ml_sim executable.
    SIMULATE precompiler definition will be used to enable simulation code.
    SIMULATE will exclude MAC address viewing and modification.
    SIMULATE will include a driver to display the virtual display on the screen.
    SIMULATE will include FEXIT command to save NVRAM and terminate application.
    SIMULATE will include command line switches to supporting enabling the terminal
display, keypad, device address and device socket port.

07/28/08 3.28.11 WJP (released to Measurement Canada)
  Updated firmware version to 3.28.11.

08/27/08 3.28.12 WJP (released to G.R.)
  Correct bug in U133 that prevented access to FCM ports over 7.
  Corrected bug in uploadable logo size on SMP that prevented uploading new
customer logos.
  Updated firmware version to 3.28.12.

09/5/08 3.28.12 WJP
  Updated makefile to build new MultiLoad II Mobile application.
    Added new "MultiLoad II Mobile" product identification graphic.
    R000 will respond with "MultiLoad Mobl" to identify MultiLoad II Mobile
product.
    The following are specific only to the MultiLoad II Mobile product.
      Added GPS selection in Communication Setup display.
      Setup default serial configuration to have GPS on COM1 and Printer on COM2.
      Added GPS Diagnostic screen under the Diagnostics Menu.
      Added GPS Site Database to store up to 4,000 site names with Lat/Log
position.
      Added GPS Site Setup screen under the Configuration Menu.
      Added new RCU level parameter "Max GPS Site Distance".  The current position
must be within this number of meters of a site in the GPS Site Database.  If this
number is zero, location verification is not performed.
      Added new "*GPS Err" alarm.  Alarm raised when no GPS fix data arrives for 60
seconds.  Also raised when a transaction is authorized and the authorization
position is not at a site in the GPS Site Database or the current position has
moved from the site where authorization was obtained.
      Updated logic to place Site Name, Latitude and Longitude information into the
last three transaction prompt fields.
      Updated duplicate ticket message will appear on left margin for small ticket
size.
      Setup default ticket configuration for a small ticket size with Site,
Latitude, and Longitude information.
      Updated idle screen to display Latitude, Longitude, Speed, Heading, and Site
Name.
  Updated Transaction Archive Header Screen to display entire length of 4 prompts
to show Lat and Long infomration.
```

```
  Added new meter level parameters "Density Alarm Time" and "Pressure Alarm Time"
to provide a time that the value must be out of spec before raising the alarm.
Same logic as the "Temperature Alarm Time" parameter.
  Updated density calculations to handle values larger then 1200.0.
    Expanded range from 1200.0 to 9999.9 for Meter Level Default Density, Density
Alarm High, and Density Alarm Low.
    Expanded range from 1200.0 to 9999.9 for Component Level Default Density.
    Expanded range from 1200.0 to 4000.0 for Meter Level Density @ 4mA and Density
@ 20mA.
  Updated RCU Setup Database version to 3.28.12.
  Updated Real Time Database version to 3.28.12.
  Added PetroPlus Logo for TTE.
  Updated firmware version to 3.28.12.

09/5/08 3.28.12 WJP
  Added support for MultiClass PIV-200 card reader to read TWIC cards returning the
card FASC-N.
  Updated card reader logic to support TWIC card reads.

  Added W&M_CLEAR alarm level that only allow clearing of alarm when W&M switch is
active.
  Added wm_clear_errors bit to bay, preset, component, meter and additive status
(MRS command).

  Added promotion_count, promoted alarm level, and alarm_count_reset_mode to the
alarm configuration.
    When an alarm occurs promotion_count number of times, the alarm level is
changed to the promoted alarm level.
    When the alarm_count_reset_mode condition is met, the alarm count is reset and
the alarm is returned to the base alarm level.
    Reset modes can be on transaction authorization, successful alarm clearing, or
a delay of time from minutes to days of up system time.
      Power cycling a system will restart the time required to return an alarm to
the base level.
    Attempts to set non-autoclearable alarms to autoclear will result in the alarm
being set to driver clearable (ie. low_flow alarm).
  Added new configuration format type, ALARM_COUNT_RESET_MODE.
  Updated Alarm Configuration Registers 710-714 to support new parameters, but
still accept updates in the old format.
  On U710-714 attempts to set non-autoclearable alarms to autoclear will result in
the alarm being set to driver clearable (ie. low_flow alarm).
  Added alarm count to "alarm raised" log message when promotion count is
configured.
  Added Additive W&M controlled parameters "W&M Inj Flt Promo Count" and "W&M Inj
Flt Reset Mode" to override registers for alarm promotion to WM_CLEAR on particular
additives.
  Added W&M logging to alarm level changes when old or new alarm levels are
WM_CLEAR.
  Updated Configuration->Alarm, to support the new Alarm Configurations.
  Updated Views->W&M Change Log, to display the new Alarm Configuration Changes.
  Updated R912 W&M Change Log to support new W&M Alarm Configuraiton Changes.

  Removed legacy R030,U030-Card Length Register.
  Removed legacy R031,U031-Card Offset Register.
  Increased size of R962-Card Data from 40 characters to 80.

  Updated Diagnostics->Card Reader to report new Card Data Format Error.
```

```
  The following are specific only to the MultiLoad II Mobile product.
    Added R/U650 to support reading or writing the GPS database.
    Added R140 to support reading the current Latitude/Longitude position.
    Added R141 to support reading the current load Latitude/Longitude/Site Index.

  Increased transaction count from 200 to 900 transactions and increased the
transaction detail count from 1750 to 3500.

  Added new additive W&M comfigurations R/U104054-W&M Inj Flt Promo Count and
R/U104055-W&M Inj Flt Reset Mode to add W&M promotions to particular additives.
  Updated Equipment Configuration Database version to 3.28.12.
  Moved placement of NVRAM6 Alibi Log to after NVRAM3.
  Updated init code to verify no overlap between NVRAM structures.

09/17/08 3.28.12 WJP
  Updated R071-074, Network Address Configurations, to be left justified.
  Corrected Alarm log messages to indicate Alarm Count.
  Added log message to indicate when Alarm Count is cleared.
  Updated Set Factory Defaults to also reset GPS site Database.
  Corrected data formatting on Access IDs and Alarm Setup screens.
  Added "W&M Access Denied" message on Alarms Setup screens.
  Corrected formatting on R140 and R114, GPS data register.
  Corrected formatting on R650, GPS Site Database register.
  Left justified alarm name in R710-R714.

10/31/08 2.28.12 WJP (Released)
  Added buffer clear to prevent old message data from bring processed with new
incomplete commands.
  Installed default company name from ML Mobile small format ticket.

10/01/08 3.28.13 WJP
  Removed legacy FCM trace logging.
  Problem with prompt display on view transaction header
  Added code to increase the number of supported fcm ports from x to 39 ports.
  Added code to increase the number of supported fcm pulse output ports from 1 to 6
ports.
    Removed bay.output_pulse_enabled parameter.
    Changed bay.output_pulse_fcm_number to output_pulse_fcm_address to include
port.
    Changed bay.output_pulses_per_volume to output_pulses_per_volume_thous with 3
implied decimal places to deliver less then one pulse per unit.
    Removed preset.output_pulse_enabled parameter.
    Changed preset.output_pulse_fcm_number to output_pulse_fcm_address to include
port.
    Changed preset.output_pulses_per_volume to output_pulses_per_volume_thous with
3 implied decimal places to deliver less then one pulse per unit.
    Added pulse output to the bay diagnostics screen.
  Updated R133/U133 to support up to 39 ports.
  Removed unused disp_bstat structure from real_time_database.
  Increased latest known FCM version to 036.
  Per Measurement Canada, whole number totals on ticket must always add up.
    Updated Preset and Load whole unit totals to sum component whole totals, and
not fractional parts, per Measurement Canada Requirement.
    Updated Component side stream back calculation to difference whole totals, and
not fractional parts, per Measurement Canada Requirement.
  Added "*" on ticket total line to indicate if totals are or are not a sum of for-
trade preset values, per Measurement Canada Requirement.
  Updated RCU Setup Database version to 3.28.13.
```

```
  Updated Real Time Database version to 3.28.13.
  Updated Equipment Configuration Database version to 3.28.13.
  Updated firmware version to 3.28.13.

10/25/08 3.28.13 WJP
  Introduced beta MODBUS register interface.

11/12/08 3.28_13 WJP
  Updated Card Reader Logic to support 26-bit, Corporate 1000 formatted cards.
  Corporate 1000 reads are returned to the Host system as 0=%04u=00000=%08u=01.
  Added ability to build a stand alone serial Opto-Iso II tester firmware build.
  Corrected bug with MRCA Request Component Alarms command returning invalid data.
Was using indicated component as preset index.
  Updated FCM II factory tests to be event based instead of time based to increase
reliability and speed of test.
  Updated FCM II factory tests to support AC expander and Relay expander boards.

12/05/08 3.28_13 WJP
  Released full MODBUS protocol and register interface as described in the
MultiLoad Communication Manual.
  Updated card reader logic to only accept TWIC card reads if two consecutive reads
indicate only one card is in the reader.
  Updated card reader logic to force a card out for approx 2 seconds when TWIC
cards are swapped.
  Add logic to keep current card during power cycle.

12/08/08 3.28_13 WJP (Released to QA)

12/19/08 3.28.13 WJP (Special Build, on ML Moble Units)
  Corrected Pulse Output Port Logic to also accept port 10 on Ver<036 FCMs and I/O
Boards.
  Added back in logic to check fcm port assignment conflicts on Pulse Output Ports.
  Increased GPS Site Database to 22,000 sites.
  Added Default Site List to MLM for Special Build
  Updated GPS site search to break up search processing over several calls.
  Corrected Database Overlap Checking startup logic.
  Updated simulation startup usage to display keymapping and notes.

12/30/08 3.28.14 WJP (released to QA for testing)
  Bug Fix:
    In certain side stream configurations and conditions (explained below), the
MultiLoad firmware did not correctly calculate one or more Component Net Volumes.
    "For Trade" Values and Calculations (Preset Level Gross and Net Volumes) were
not effected.
    Only "Not for Trade" or "For Inventory Only" Values and Calculations (Component
Level Net Volumes) were effected.
    Problem limited to the previous version of firmware 3.29.11-3.29.13.
    Problem limited to configurations where more then one main component shared the
same side stream component.  For instance, Reg and Prem components sharing a
ethanol side stream.
    Problem limited to recipes that included flowing both of these main components
sequentially in the same blend.  For instance, Reg flow with Ethanol side stream,
followed by Prem flow with Ethanol side stream.
    Problem limited to the calculation of the Net Component Volumes calculated for
any main components with a common side stream that flow after the first main
component with the common side stream in the blend.  For instance, the Premium
component in the previous example.
```

Main Component Net Volume error on effected components would always be an understatement in the amount of side stream net volume that flowed during the previous main components with the common side stream.
Corrected placement of "*" when performing a sequential or ratio blend with a side stream.
Updated application of API VCF and meter calibration to perform rounded calculations.
Updated firmware version to 3.28.14

1/13/08 3.28.16 WJP (released to QA for testing)
Corrected placment of "*" on additive net on printed ticket.
Corrected titles on factory Optical Isolator Test.
Updated firmware version to 3.28.16

1/22/09 3.28.16 WJP (released to Measurement Canada for testing)
Added Meter Net/Gross to Component Status Screen.
Added Transaction Detail Record for Component Meter (Per Measurement Canada Requirement).
Updated transaction database and transaction printing to support type 4 details.
Changed transacction database version to 3.28.16.
Kept firmware version the same since 3.28.16 was not released to production or outside Toptech.

1/28/09 3.28.16 WJP
Added Analog Test/No Cal function to FCM 2 Factory Test.

1/30/09 3.28.16 WJP (Released)
Corrected bug in reading Modbus register 4180 (Preset Batch Rate).
On FCM II Factory Calibration function, increased threshold on missed COM messages to avoid restarting calibration over again when FCM updates internal EEPROM after a successful calibration.

3/4/09 3.28.17 WJP (released)
Corrected bug in TEC and TEC-ETH API tables where temp/10 was being delivered to the calculation.
Corrected bug in TEC and TEC-ETH API tables where temp > ref_temp, calculation would always produce grossly invalid value.
Added Preset Configuration Parameter "Stop Start Delay" to prevent stop and start within x time to eliminate concern with Rogue Smith Pulsers.
Set parameter to 45 seconds to prevent Rogue Smith Pulsers from activating alternate operating mode.
Do not raise an alarm, just start flow after delay expires.
Log message when Driver attempts to start flow within this time for later analysis/tracking.
Updated Real Time Database version to 3.28.17.
Updated firmware version to 3.28.17.

2/26/09 3.29.01 WJP
Updated PetroPlus logo per customer supplied graphic.

To support dynamic Configuration Parameters that may change from general to W&M controlled parameters, all W&M parameters have been moved into general areas and the W&M Menu has been removed.
All W&M controlled parameters are now displayed in red and are still protected from modification via the external W&M switch. Screens include RCU Setup, Bay Setup, Preset Setup, Component Setup, Additive Setup, Additive Calibration, Meter Proving, View Temperature, View Density, View Pressure, Temperature Comp, Pressure Comp. Alarm Setup

Updated PickList routines to support attributed (color selection) of items in the list.
Moved all W&M Equipment Configurations back under Equipment Configurations.
Moved Temperature, Pressure and Density Calibration functions to the Temperature, Pressure and Density View Screens.
Moved Temperature Comp and Pressure Comp screens from the W&M Menu to the Views and Inquiry Menu.
Updated Alarm setup screen to display Alarm configurations under W&M control as Red and restrict saving changes with W&M switch active.
Added new configuration parameter level of CONDITIONAL to indicate parameters that can be switched into or out of W&M control.
Added Preset Configuration Parameter "W&M Controlled" that adds W&M write protection via screen and remote register access (inc. Modbus) to certain parameters.
Changed level of "Blnd Chk Alarm %", "Blnd Chk Alarm Vol", "Blnd Chk Alarm Time" to CONDITIONAL.
Added Additive Configuration Parameter "W&M Controlled" that adds W&M write protection via screen and remote access to certain parameters.
Changed level of "Additive Vol/Inject", "Vol/Inject Cal Factor", "Additive Mtr K-Factr", "Additive Mtr Factor", "Max Pstn Missed Inj", "Under Add Alrm # Inj", "Over Add Alrm # Inj", "Check Add Tol Time", "Over Inj Vol" level to CONDITIONAL.
Removed Additive Configuration Parameters "W&M Vol per Inject", "W&M Vol factor", "W&M Pulses per vol", "W&M Pulse Factor" since no longer needed.
Added Component Configuration Parameter "W&M Recipe Percentage" to enforce delivery.
Corrected Meter Proving Screen Meter Factor data entry data column alignment.
Updated Equipment Configuration Database version to 3.29.01.

Added printer multidrop capability to Ticket Printing.
Added printer multidrop capability to Alibi Log Printing.
Added ability to multi-drop several MultiLoads on to a single printer using RS232 on COM2. Connections must be as follows:

```
ML#1            ML#n                    Serial Printer
RX<-------------RX<--------------------TX
CTS<------------CTS<-------------------DTR
TX------------->TX--------------------->RX
GND-------------GND--------------------GND
DSR-DTR         DSR-DTR                 RTS-CTS-DSR
RTS-DCD<------->RTS-DCD                 DCD
```

Added more discrete control of the Transmitter Enable to support having multiple MultiLoads connected to a single printer.
Dropped monitoring of DSR or DCD for printer status. CTS indicates printer status.

Added Meter Configuration Parameters "Adaptive Valve Control", "Analog Valve Control", "4-20mA Increase Step", "4-20mA Decrease Step" to support analog valve control.
Allow ports 2 & 3 to be used as general IO when Analog Valve control is enabled.
Increased latest known FCM version to 037.

On FCM_TESTER and ISO_TESTER build, allow entry into factory menu.

Updated FCM2 Analog Calibration to ignore COM timeouts when setting calibration values during test. Was causing test to sometimes restart when FCM was writing to EPROM and not communicating.
Updated FCM2 Analog RTD/mA Calibration to perform 3 tests then stop.
Updated FCM2 Analog RTD/mA Check to perform 1 test then stop.

```
  Added Legacy ACR test to Factory Menu.

  Expanded Configuration Prompts Register, r100-104, to return a max of 90 bytes
and a default of 30 bytes (instead of 20 bytes) to support UTF-8 worst case.
  Increased size of Alarm Names storage to handle UTF-8 characters.
  Expanded Alarm Configuration Registers, R/U710-714, to return 30, instead of 10
bytes to support UTF-8 worst case.
  Expanded Modbus Alarm Configuration Registers, 2500-2599, to return 15, instead
of 10 bytes to support UTF-8.
  Updated Alarm Setup Screen to properly display UTF-8 strings.
  Updated RCU Setup Database version to 3.29.01.

  Added W&M logging of firmware updates by monitoring the current firmware type,
version and build date on startup (Canada & US W&M req.).
  Added W&M logging of when any database is reset to factory defaults.
  Expanded W&M Log Register, R912, to support Firmware Updates and Factory Default
events.
  Updated View W&M Log to support Firmware Updates and Factory Default events.
  Updated start_clock() to immediately poll RTC for current date/time at startup to
prevent W&M and Event logs from reporting 00/00/00 00:00:00.
  Updated W&M Log and Totalizer Database version to 3.29.01.

  Added lcd_driver code to read the LCD device ID from display color lines.
    Binary set of 10K pull down resistors on Blue color lines identify LCD display
model connected.
    0x0000 = 8.4 VGA with limited 50-100% on backlight dimming, no pull down
resistors on color lines.
    0x0001 = 8.4 VGA with full 0-100% on backlight dimming, 10K Pull Down on
Display Board Blue 1 (LSB) color line.

  Corrected bug in Output Pulse Port processing where specification of port 10
would not send pulses to IO board.  Workaround was previously to specify port 1 for
port 10 on IO boards.

  Removed qml, qml1, qmlm targets from the Makefile build script.

  Updated firmware version to 3.29.01.

4/6/09 3.29.01 WJP (released for testing)
  Corrected alarm count to allow up to promo count alarm clears before promoting to
new level on next alarm.  Previously promoted on promo count alarm occurance.
  Moved Blend Check Start Vol and Blend Check Restart Vol under Conditional W&M
control.
  Corrected U600 register to correctly parse both 0, 8 and 16 lockout bits on stand
along card database.

8/5/09 3.29.02 WJP
  Correct bug in card reader code that prevented correct identification of some
corporate 1000 HID cards.
  Updated simulation display terminal code to display utf-8 unicode and text
foreground/background colors.
  Added "Toptech Product ID French" graphic screens.
  Added "Total Oil" and various other customer logo graphic screens.
  Replaced "Toptech Global Solutions" with "Toptech Systems" graphic screen.
  Updated "MultiLoad" (English, Spanish, French) product ID graphic screens.
  Updated code to bring in product ID graphics as raw files in /rcutlc4/bmp
directory instead of compiled C const structs.
  Updated U/R 990 and 991 registers to work with new .raw file method.
```

```
  Removed ml1 (MultiLoad 1-Arm) target from the Makefile build script.
  Updated ML package firmware to contain 1-Arm product id string to allow legacy 1-
Arm firmware to upgrade to this and later full MultiLoad versions.
  Updated simulation get_ticks() to not log warnings about non-monotonic system
timer jitter on Lunux.
  Updated simulation to work with backspace key for clear.
  Corrected bug in Diagnostic Display Unicode where rolling backwards would attempt
to display code point 0xffffffff.
  Updated firmware version from 2.29.01 to 3.29.02.
  Updated product recipe register to support 6 additives.
    Updated Modbus 2200..2271 interface to support 6 additives in a recipe.
    Updated R/U500 to support 4 and 6 additives in a recipe.
  Added French language prompts.
  Include Additive Under_add and Over_add alarms under conditional W&M control.
    Renamed additive cofig parameters "wm_inj_fault_promo_count/reset_mode" as
"wm_alarm_promo_count/reset_mode".
    Added logic to handle alarm promotion and clearing for Under_add and Over Add
alarms.
  Changed "Max Solenoid Injection Time" from General to Conditional W&M control.
  Added support to store up to 10,000 transactions.
    Updated Transaction Archive Database version to 3.29.02.
    Moved transaction storage from NVRAM to last 10 MB of program flash memory.
    Max storage size based on 10,000 transactions, 20 details per transaction and
max clear block size at program startup.
    Tickets numbers are 1-9999 inclusive.
    Removed sidx from header record, and hidx from detail record.
    Updated FBOL (find first transaction for a specified date) to work with large
transaction database.
    Updated factory defaults to clear all transactions and transaction flash
blocks.  Will loose COM during operation.
    To greatly reduce possibility of a missed COM message while erasing a flash
block, added support on reboot to verify at least 256K of flash transaction storage
is available.
    Added powerup text when unlocking transaction flash blocks to explain new
powerup delay.
    Added "TRACE_ARCHIVE" ifdef to allow logging of storage actions and locations
for debugging.
    Setup AUTOLOAD when tracing archive to load one 10-15 gal preset for each
transaction to quickly load the entire transaction archive (30-40 Hrs).
    Updated modbus 7810..7916 interface to read expanded transaction archive.
    Updated R800 to read expanded transaction archive.
  Added ability to send dual output pulse.
    For dual pulse, FCM_2 or IO_BOARD version must be 38 or greater.
    Indicate use of dual pulse by turning on invert flag on output FCM port
configuration parameter.
    Second pulse will always be on the next port, 0/1, 1/2, 2/3, 3/4, 4/5, 10/11,
11/12
    Note: Single Output Limited to 500 Hz, Dual Pulse Output Limited to 250 Hz.
    Note: As before, output pulses are not real time and delayed approx. 1 second.
  Added logic to only allow resetting to factory defaults when W&M key active and
on a powerup.
  ML Simulator Updates:
    Updated simulation to display log messages to console.
    Added exit code to restore proper terminal functionality when closing the
program.
  Added digital control valve state into meter_trace as 0=close, 50=lock, 100=open.
  Corrected bug in 1-Arm and SMP products where preset level alarms could not be
manually cleared from preset control and preset status screens.
```

```
  In FCM2_TESTER build, added I/O board digital output, digital input, analog cal,
and analog test functions.
    Updated FCM 2 Analog Tester to correctly exit RTD calibration mode.
    Updated "4-20mA Input" to more descriptive "Observed 4-20mA".
  Display yellow background on parameters changed from the default on RCU, Bay,
Preset, Component, Meter and Additive configuration screens.
  Added "Id:X" to R912 W&M Log Register to include an Id with each W&M change
logged by TMS.
    Updated R912 register to contain the ID of person that performed that change.
  Updated View W&M log to have the ability to print a W&M log.
  Added new terminal esc sequences for:
    Added <esc>G command to set Foreground/Background text colors
    Updated <esc>J and <esc>K to clear to EOL and EOS with color and size
attributes.
    Added <esc>d command to Draw Customer Logo
    Added <esc>e command to Draw Graphics Bitmap
    Added <esc>g command to Fill Graphics Box with Color
  Corrected API Table TEC-ETH to correctly apply TEC values.  Was off by *10 on the
application of the TEC.
  Corrected spelling of Component in the W&M change log.
  Corrected TTE reported bug in Modbus 7000 register not resetting HOSTUP timer.
  Corrected new bug that prevented printing tickets after a load.
  Corrected new bug that caused line to not increment when printing details.
  Corrected bug sending a UTF8 character instead of extended ascii to the ticket
printer.

10/30/09 3.29.02 WJP
  Corrected bug in ticket printing where line-feed character was not printing after
each line.
  Corrected communications ports wrong factory default values.
  Corrected bug in display type checking.  Caused some legacy displays to dim too
much with the screen saver enabled.
  Added ability autodetect display type and support QVGA.
  SMP will default to QVGA for unknown displays.
  ML will default to VGA for unknown displays.
  Added identification of display id #0000 for legacy 8.4" displays.
  Corrected bug that prevented alibi log printing on multidropped configurations.

11/02/09 3.29.02 WJP (released to QA)

11/11/09 3.29.02 WJP
  Added card reader ability into SMP firmware, but defaults to disabled.

11/16/09 3.29.02 WJP
  Added ability in view transaction archive details to display batches that have
the alarm flag set in red.
  Added Batch_Alarm preset status bit (on MRS command) to latch any preset alarm to
be reported on transactions.

11/20/09 3.29.03 WJP
  Updated SMP graphic to high resolution version.
  To support adding back in card reader for SMP Div 2, also added back in Prox Card
Pull Secs and No Prox Pull If Flow parameters.
  Corrected bug that prevented dual pulse output from working on port 2/3.
  Updated preset, meter and component totalizers to accept and view volume in whole
units or hundredths.
  Updated backflow totalizer logic to capture 100s without dropping percision
across whole numbers.
```

```
  Added new W&M RCU Setup parameter "Use Hundredths", R030, to enable display,
recording, and totalizing in hundredths.
  Added support to transaction archive and alibi log for viewing or printing whole
units or hundredths.
  Updated Transaction Detail view screen to display whole units or hundredths.
  Corrected ticket printing of leading zeros on temperature, pressure and density.
  Updated Serial and Modbus interface for totalizers, transaction archive to return
implied two decimal places when the "Use Hundredths" parameter (R030) is enabled.
  Updated firmware version to 3.29.03.

12/14/09 3.29.04 WJP
  Added API tables 60o and 901A for TTE.
  Updated firmware version to 3.29.04.

12/15/09 3.29.05 WJP (merge with atmel development)
  Updated firmware version to 3.29.05

12/16/09 3.29.04 WJP
  Correct remote picklist processing to setup default colors when picklist is
written.  Bug caused picklist items to appear with black foreground and black
background when host displayed a picklist.  Problem would only occur between
powerup and first time entering program mode.  Once program mode was entered,
picklist would display correctly.  Picklist would always appear on RCU ditto even
when displayed items were black.

2/23/10 3.29.06 WJP (Beta Release to Sam Yu)
  In MAC address setup, allow specification of most resent IEEE assigned MAC
address block.
  Include NanoSleep() call in linux simulator build to prevent idle task starvation.
  Updated firmware version to 3.29.06
  Added Chinese language to product.
  Started adding eMail support.
  Todo: add registers for email settings.
  Increased configuration prompt string from 30 to 45 bytes (max 30 ASCII
characters or 15 UTF-8 characters 3-byte each).
  Increased language prompt string from 40 to 60 bytes (max 40 ASCII characters or
20 UTF-8 characters 3-byte each).
  Added HTTP server.
  Added, for now, engligh product graphics for portuguese and chinese.

4/14/10
  Added conoco Farmington density alarm timeout modification for air in line. Only
time timeout when not in alarm and authorized to allow time for correct density to
be read.

4/30/10 3.29.06 WJP (ILTA Demo)
  ILTA Mass Meter Demo Code
    Updated Krohne meter diagnostics to include more registers.
    Update FCM control logic to deal with mass meter flow with on/off valve for
demo.

5/5/10 3.29.20 WJP (release to QA)
  Merge of parallel development streams back into one!!!
  Added Mardarin language.
  Changed all variable flags from char to int to improve efficiency.
  Changed all string usage of "unsigned char" to "char" for compiler compatability.
  Started email functionality development.
```

```
  Updated serial routines to use integer instead of character configuration
parameters.
  Added web server functionality.
  Added routines to get and set ethernet MAC address for new and old processor.
  Added ML_Mass build for demo of Krohne meter at ILTA.
  Density alarm, 4-20mA values outside 4-20 are to be treated as an error and
density set to zero.
  Added time delay on density alarms.
  Added code to support uploading new firmware on new processor.
  Added ablity to support 3 host connections at the same time.
  Corrected simulation build processor utilization bug by adding nanosleep call.
  Changed firmware version to 3.29.20.
  Changed all database versions (except NR3-W&M & Totalizers) to 3.29.20.

5/17/10 3.29.20 WJP (release to QA)
  Added Factory Test function to verify the installation of OptoFCMs firmware in
FCM I and FCM II.

5/18/10 WJP Rev 9.26.20
  Corrected web display of W&M Log and Event Log.
  Increased latest known FCM version to 038.

5/21/10 WJP Rev 9.26.20
  Corrected bug that prevented multidropped alibi log printing from releasing the
control line.

6/7/10 WJP
  No Changes

7/26/10 WJP
  Added W&M protected parameter to enable FCM simulation for demo and debug
purposes.  "Simulation Mode" is displayed on loading screen
  Updated all logo code to use .c const struct inclusion in place of binary files
for bitmaps.
  Minor changes to remove Keil compiler warnings messages.
  Currected bug in standalong card processing when searching for 2nd occurance of
the same card number with a different PIN.
  Moved AT91SAM9G45 modbus code to use PXA255 super-switch.
  Corrected modbus extended services command execution bug where command execution
would occur at the completion of any write to the ESR, not just at the write of the
last register.
  ESR changed from unsigned char to char to eliminate compiler warning.
  Added start_alt_high_flow_rate and end_alt_high_flow_rate parameters to delay
entry into and exit from alt high flow for use with the LC bubble detector.
  Added preset Permissive Alarm Time parameter to delay the occurance of a
Permissive Alarm for use with the LC bubble detector.
  Added additive Upstream Block Valve parameter to allow the automatic opening of
the additive block valve during additive calibration.
  Added logic to allow the delivery of a single side stream component for meter
calibration while in proving mode.
  Added logic to mark side stream component as complete when main meter is complete
to prevent side stream from running on when main stream stops.

9/10/10 WJP
  Continued debugging of Atmel routines for Card Reader, Real Time Clock, Flash
Memory, LCD Driver, Serial Ports, Network.  No impact to existing PXA255 code.
  Rewrite and simplify ExL Alphanumeric Entry code.
```

```
  Updated software ID to be different for PXA255 vs Atmel builds to prevent upload
image swap.
  Added start of hardware watchdog timer at startup.
  Updated software major number for new platform builds.
  Disabled much of the email WIP code.

9/17/10 WJP
  Added ability to accept analog flow meter inputs.
    Added signed_div1000 and meter_input_type to configuration parameter types.
    Changed "Pulse in Mass" meter configuration parameter to "Meter Type".
    Added several "Analog Meter Input" parameters for @4mA Rate, @20mA Rate, Rate
Offset, and Cutoff Rate.
    When Meter Type is Volume Analog Input, ports 4 and 5 can be used for other
functions.
    Updated meter diagnostic screen to display Input mA.
  Corrected Mandarin LOW FLOW and HIGH FLOW text.
  Increased latest known FCM version to 039.
  Added R/U998 to read/update bitmap cache data area (16MB 0x00000000-0x00ffffff).
  Added T`hrcwhooooooooo command to display graphics from the cached bitmap data
area.
  Changed firmware version to 3.29.21.
  Changed equipment database version to 3.29.21.



10/7/10 WJP
  Added a blue screen exception handler that will display the type of fault,
address of fault and all register values.

12/9/10 3/4.30.00 WJP
  Switched to eCos RTOS for Atmel processor (same OS as xScale uses).
    Removed all references to IAR and Keil compilers and RTOS.
  Added Atmel Exception Handler Blue Screen.
  Added CN GPS tracking demo code.
    Added 200 gps position log.
    Added compiler switches for GPS_SITE_DATABASE and GPS_POSITION_LOG.
    Replaced Modem Sign On configuration parameter with Host Sign On. (Language
Conversions needed)
    Added TDS 3PO interface routines.
  In process: Adding Krohne and Micromotion functionality
    Removed ILTA Mass Meter demo code.
    Added Mass Meter Real Time Status Registers.
    Added VOLUME_KROHNE(3) and VOLUME_MICROMOTION(4) to meter type enumeration.
    Added MASS MTR to the Communication Setup port type.
    Added Mass Meter Diagnostics to Meter Diagnostic Screen.
    Corrected bug where the input of UNSIGNED_DIV1000 formatted parameters accepted
the selection of a sign.
  Removed workaround to force state to idle when powerup and a transaction is
completing.
  Addws SD Card Functions.
    Added SD Card selection to the Views and Inquiries Menu.
  Changed firmware version to 3/4.30.00.
  Changed real time database version to 3.30.00.

12/20/10 3/4.30.00 WJP
  Added new Calculations for Shell Canada and Measurement Canada V18.
    For Side Stream Calculations:
```

When a default density value is supplied or measured at the meter level, this density value is accepted as the meter density and is applied to API calculations on the received meter volumes.

When a default density value is not supplied or measured at the meter level, a blend weighted density is calculated from the component densities and is accepted as the meter density and is applied to API calculations on the received meter volumes.

When a default density value is supplied at the component level, this density value is accepted as the component density.

When a default density value is not supplied at the component level, a back calculated density is calculated and is accepted as the component density.

Meter sampled temperature continues to be used for the API calculation on the received meter volumes.

The meter temperature/density can still be viewed on the Component Status Screen next to the calculated CTL/CPL values.

The meter temperature/density, gross and calculated net volumes still appear on the meter line of the printed ticket.

Main component temperature is once again back calculated to keep back end accounting systems happy.

The component temperature/density, gross and net volumes appear on the component line of the printed ticket and are marked not for custody transfer.

A host system that queries for real time component level values will be supplied with the same component temperature/density, gross and net volumes that appear on the component line of the printed ticket.

A host system that queries for real time component meter level values will be supplied with the meter temperature/density, gross and net volumes that appear on the meter line of the printed ticket.

A host system that queries for the transaction archive information will be supplied with all same meter and component information that is on the printed ticket.

Setup Component and Meter Temperature/Pressure/Density real time component data.

Setup Component and Meter Gravity/Density get routines.

API routines always use Meter Temperature/Pressure/Density from the real time component data.

Transaction Component Data always contains component Temperature/Pressure/Density from the real time component data.

Transaction Meter Data always contains meter Temperature/Pressure/Density from the real time meter data.

MRS command component data returns component Temperature/Pressure/Density from the real time component data.

Modbus 4756..5331 register, contains component Temperature/Pressure/Density from the real time component data.

Component Meter Screen displays the meter Temperature/Pressure/Density from the real time component data.

Renamed RCU parameter "Print Blend Components" to "Print Blend Details". When set to 2, all meter records will be archived and printed.

1/5/10 3/4.30.00 WJP

On Simulation builds, send transaction to display.

Move NR3 by 0x1000 bytes to prevent overlap.

Updated MRS and MSS commands to support configuration bits to return meter level parameters.

Added meter level pressure/temperature/density to the component status screen.

Followup: Check meter detail print logic on ml_main:2050.

Followup: Add Modbus registers for meter level gross/net/temp/press/density.

```
2/3/11 WJP
  Transacton archive lockup issue resolved.
    After a card out on 3.29.xx firmware, there was a slight possibility of the
following issues occurring:
      - Lockup on preset screen while displaying a status of clearing on one or
more arms.
      - Lockup on transaction complete screen.
      - Real time clock updates stop.
      - Loss of serial or Ethernet communication.
      - Loss of keypad operation.
    Upon power cycle after the issue:
      - Lockup on preset screen display with status as blank or clearing on one or
more arms.
      - Lockup on blank white screen.
      - Real time clock stuck at 00/00/00 00:00:00.
      - Factory defaults were required to regain control.
      - Multiple power cycle operations to regain real time clock operations.
    Root Cause:
      - Operating System flash routines were flushing and disabling the CPU cache
with both the scheduler and interrupts enabled.
      - If a task switch or interrupt occurred while flushing the cache, but before
disabling the cache, DRAM memory updates were lost.
      - When this occurred, one of more tasks would stop running, the system could
lock up or the system state would become invalid.
    Solution:
      - Disable CPU cache in the MMU at startup for the flash memory area.
      - Use application flash routines that do not modify CPU cache states.
      - Added check for all presets complete to end transaction in case previous
end transaction was interrupted.
        - Remove background processing in end transaction routine to prevent
recursion with previous change.
    Build now links with pxa255-rcu-lib-romram-net-11 with cache disabled on flash
address space.
    Use application flash routines for firmware and transaction updates. (Verify
firmware update functionality)
    For PXA255, Flash block unlock routine checks lock status before unlocking
flash blocks.  Transaction archive blocks are left unlocked.
  Corrected issue with reading transaction details on the Modbus interface.
  Restored ability to remotely modify time without an active W&M switch (changes
are W&M logged)
  Updated copyright date.

2/8/11 WJP
  Increased the number of allowable additives in a recipe from 6 to 12.
  Changed firmware version to 3/4.31.00.
  Realigned all NVRAM structures for new fields (totalizers will not be preserved
from previous versions)
  Changed all NVRAM DBASE versions to 3.31.00.
  Added ability to place compartment number on standalone ticket.
    Added column position to R203 command. (MultiMate update needed)
    Adjusted default ticket to display compartment number and also have room for
totalizer widths.
  Added remote clear input to clear batch on external input.  (No Flow, No Alarm,
Load Complete)
    remote_clear bit added to preset status.
    Added new Preset configuration parameter, "Remote Clear FCM#".
  Added ability to read a live relative density.
    Density error will be reported for a density or relative density error.
```

```
    Added new Meter configuration parameters to support live Relative Density input:
      "Relative Density Sensor Enabled"
      "Relative Density Sensor FCM#"
      "Default Relative Density"
      "Alarm Low Relative Density"
      "Alarm High Relative Density"
      "Relative Density Alarm Time"
      "Relative Density at 4mA"
      "Relative Density at 20mA"
      "Relative Density Offset"
    Added new Component configuration parameter, "Default Relative Density".
    Relative Density weighting calculations are the same as Density Calculations.
    Added ability for API functions to use live Relative Density.
    Added ability to read component current relative density in MRS command.
    Added ability to read component meter current relative density in MRS command.
    Updated preset and component status screens to display relative density.
    Added ability to read component current relative density from Modbus register
6292 ... 6483.
    View Relative Density Screen (modify offset) added to Views and Inquiries.
    Updated API table setup screen to handle test Relative Densities.
  Corrected bug where if entry into program mode followed PIN input, caused "***"
to appear when entering numbers in program mode.
  Updated view transaction to display density instead of pressure.
  Updated view transaction to display totalizers stored in transactions.
  Updated view transaction to display no net, temperature or density for additives.
  Removed dates and line number from message log display to increase the display
from 57 to 71 characters.
  Added ability to include ending totalizers in a transactions.
    Added new configuration format type TOTALIZER_SELECTION=25. (MultiMate update
needed)
    Added new RCU configuration parameter, "Print Totalizers" to select what
totalizers (PMCA) should be included in a transaction and alibi log.
    Increased the max number of Transaction Details from 99 to 999.
    Added optional extension to R800 register to support reading details over 99.
    Added blank line between each preset totalizer groups printed on ticket.
  Added new Preset configuration parameter, "Default Preset" to automatically enter
a preset quantity.
    Updated preset prompt routine to skip preset if default preset is specified.
  Added new Meter configuration parameter, "Meter Address" to specify the Modbus
address of a serially connected mass meter.
  Added new W&M Component configuration parameter, "API Extrapolated Range" to
allow the use of API tables in the extrapolated ranges.
  Updated proving mode to always use proving low flow rate and proving low flow
volume.
  Corrected bug in Preset Net Totalizer not correctly showing preset net volume
with side stream.  Component 1 Net was also impacted, but transaction volumes were
not affected.
  For meter creep on an unauthorized batch, preset product code is now "CREEP "
instead of "000000" (first product).  Product description on ticket displayed at
"MeterCreep".
  Updated ticket printing routine to print product code from transaction and not
the currently loaded product list.
  Updated set clock routines and serial interface to return an error when values
are out of range.
  Increased range of low flow alarm time from 65.535 seconds to 999.999 seconds.
  Added new Preset configuration parameter, "Auto Batch Authorize" to support auto
batch authorizations when product and volume are already specified and program key
off in standalone mode.
```

```
2/10/11 WJP (release)
  Added BP Customer Logo.

2/21/11 WJP (release to QA)
  Updated 4449 inspection mode to directly access W&M change log (bypassing views &
inquery menu).
  Corrected bug with density and relative input density format in the Temp Comp
screen.

2/24/11 WJP (release to QA)
  For AT91SAM9G45 flash, added ability to properly handle top boot flash (first 100
boards shipped).  May cause later transactions not to be written to flash.
  Correct bug in handling NO_TRANSACTION state after firmware upgrade causing a
blank screen on first startup.
  Corrected bug where if back calculating density or relative density for a main
component of a side stream, logic was only looking at the side stream meter density.
Logic now also checks side stream component density.
  Added safety check for max number of transaction details on loops.

4/8/11 WJP Rev 3/4.31.01 WJP (release)
  Updated vsprintf() calls to handle null return strings.
  Corrected DMA buffer alignment issue on Atmel CPU boards that caused some serial
messages to be corrupted and old messages to be reprocessed a second time.
  Updated Diagnostic Serial Port Test to also perform full duplex tests.
  Changed firmware version to 3/4.31.01.

5/4/11 WJP Rev 3/4.31.02 WJP
  Added Preset level configuration parameter "Compute Blend Density".
    When meter level density is not defined and component level density is defined,
      if Compute Blend Density is enabled, the meter density is computed by a
volume weighted average of the component densities.
      if Compute Blend Density is not enabled, then meter density is taken from the
main component density.
  Changed firmware version to 3/4.31.02.

6/2/11 WJP
  Corrected bug in Component Net Totalizer.
    On side stream blends it was possible that the side stream volume would clear
before the main component cleared.
    This would cause the component totalizer to bump up by the side stream amount.
    This bug did not impact any volumes reported on the transaction.

6/27/11 WJP
  To prevent a false API_TABLE alarm when side stream flow is ahead of main product
stream, only call API calculation when component batch_gross_del_hund_signed > 0.

6/2/11 WJP
  Added Analog Valve 4-20mA output controls to Meter Diagnostics screen.

7/1/11 WJP
  Added hardware toggle of COM 2 DTR and RTS signals on startup with TX enabled to
sync outputs and inputs with optical isolator.


7/5/11 WJP
  Added clear of API table alarm when exiting the program mode - temp comp screen.

7/5/11 WJP (release)
```

```
  Corrected Web RCU Ditto processing of the stop key.


7/19/11 WJP
  Added Preset, Component and Additive product names to the alibi log.

7/19/11 WJP
  Added new configuration W&M protection type of CONDITIONAL_DENSITY.
  Added new configuration parameter "W&M Density Lock", that will conditionally
move default density, default relative density and API gravity parameters under W&M
protection.

7/26/11 MSH
  For CN Builds, added truck_no, carrier_id, tds_retry_interval, seller_id,
consignee parameters.  No register access.
  For CN Builds, added comments, is_manual_bol, transaction_id and cosignee to
transaction archive header.  TDS access only.  No register or print access.

7/28/11 WJP
  Added Boot Screen and R000 extension to identify custom built firmware.

8/9/11 WJP
  Corrected "ReprintTicket" prompt to only reprint ticket on Next keypress, not
Enter keypress.

8/23/11 WJP
  Added clear of entire nvram DB blocks to avoid config problems when switching
between build types.
  Added check for struct size exceeding block size.
  Added start and end dates to transaction headers for use with TDS records.
  Updated Transaction Archive database version.
  Updated GPS, GPS_SITE_DATABASE and GPS_POSITION_LOG compiler switches.

8/24/11 WJP
  Added TDS_INTERFACE precompiler switch for selective inclusion.
  Updated support for CONFAR_BUILD and CN_BUILD precompiler switches.
  Removed MULTILOAD_MOBILE_BUILD precompiler switch and logos.
  Increased SOFTWARE_BUILD_ID size from 15 to 25 characters (R000 and boot screen
display).
  For CONFAR_BUILDs, added LAT,LONG and WELL NAME to TDS transaction comments.

8/24/11 WJP
  Bumped position log from 200 records to 500 records.
  Increased GPS database block size from 512K to 1M.
  Cleaned up GPS data on Idle Screen to allow for GPS_SITE_DATABASE and
GPS_POSITION_LOG at the same time.

8/24/11 WJP
  Clean up RCU Setup Screen for selective inclusion of TDS_INTERFACE prameters.

8/26/11 WJP
  Added automatic selection of Conoco Logo on CONFAR builds.

9/9/11 WJP
  Correct display of Load Volume on the Main Preset Screen to display Hundredsths
if Use_Hundredths is enabled.
  Added printing of Average Load Temperature if the Load Totals are displayed
directly under the transaction details (tot_gpos=99 and tot_glin=99).
```

```
9/9/11 MSH
  Added support for two-meter I/O board automated test rig.
  Changed prompting sequence to use Driver Language setting in RCU Setup rather
than language bit in card database.

10/3/11 MSH
  Added vehicle ID as prompted in transload to truck scenario to transaction sent
to TDS.
  Added "BOL Prefix" configurable to RCU General Setup for CN builds. Prefix is
user adjustable and is prepended to ticket number when sent to TDS.

10/4/11 WJP
  Added ASTM1240-2004 tables.
    Added the following configuration types:
      COMMODITY_TYPE     = 28,
      EXP_COEF_UOM_TYPE  = 29,
      DENSITY_UOM_TYPE   = 30,
      PRESSURE_UOM_TYPE  = 31
    With the following assignments:
      #define COMMODITY_TYPE_NONE           0
      #define COMMODITY_TYPE_CRUDE          1
      #define COMMODITY_TYPE_REFINE         2
      #define COMMODITY_TYPE_LUBRIC         3
      #define EXP_COEF_UOM_TYPE_FAHRENHEIT    1
      #define EXP_COEF_UOM_TYPE_DEGREES       2
      #define DENSITY_UOM_TYPE_KG           1
      #define DENSITY_UOM_TYPE_API          2
      #define DENSITY_UOM_TYPE_REL          3
      #define PRESSURE_UOM_TYPE_PSIG        1
      #define PRESSURE_UOM_TYPE_KPA         2
      #define PRESSURE_UOM_TYPE_BAR         3
    Added the following W&M Component configuration parameters:
      commodity_type;                      /* 103048 */ \
      exp_coef_uom;                        /* 103049 */ \
      density_uom;                         /* 103050 */ \
      pressure_uom;                        /* 103051 */ \
      reference_temp;                      /* 103052 */ \
    Added ability to selectively display these parameters on the Temp Comp screen.
    Updated Makefile to include:
      ml_api_2004_5.c
      ml_api_2004_6.c
    Added the ASTM 2004 table types.
    Changed equipment database version to 3.30.03.
    Added long table name for display.
    Increased CTL table count from 21 to 48.
    Added ability to display and use 5 decimal place VCFs.
      Component Status Screen 4 and 5 digit CTLs.
    Increased API table name size on the API Table Setup Screens
      TODO: Need to update USE flags for 2004 tables.
      TODO: Need to return correct density types for transaction.
      TODO: Need to retest all 2004 tables.
      TODO: Need to address CTPL values.

10/14/11 MSH
  Added option to SD card menu to dump diagnostic data to SD, including contents of
NVRAM and flash transaction archive.
```

```
  Fixed improper BOL number when packing transactions.
  Changed order of operations in TDS task, so that any pending transactions will be
sent first.

10/17/11 MSH
  Filter tankcar list by terminal ID.
  Sort Vendor BOLs by BOL number.

10/17/11 WJP
  Added new configuration parameter (U075) of http_port to allow using alternate
ports or complete disabling (http_port = 0) the http service.
    This value defaults to 80 (enabled).
    On simulation firmware builds, http port is stilll +1000 of the specified host
port.
  Updated CTL Setup screen to correctly display needed parameters for 2004 tables.
  Updated logic to return density, rel density, gravity, etc. when no table is
selected.
  Limited "Local Databases" on Diagnostics to only CN builds.

10/20/11 WJP
  Updated 2004 tables to only include needed parameters.

10/21/11 MSH
  Changed TDS task to only reset the task if in an idle/error state.

10/21/11 WJP
  Added new 2004 api "X" tables.

10/25/11 WJP
  Removed legacy touch I/O from Makefile.
  More debugging on 2004 API tables.
  Corrected format of Density/Rel Density/Exp Coeff/API Gravity on stand alone
tickets and in the transaction viewer.
    Removed compartment from the transaction viewer.

10/28/11 WJP
  More updates for API tables.
    Replaced CTL and CPL with VCF on screens.
    Replaced CTL and CPL table configuration with VCF table configuration.
    Replaced Temp Comp and Press Comp setup screens with API Table setup screen.
    Moved 11.2.2M to API table 54. Moved 11.2.2 to API table 24e.  CPL calculation
done when pressure is not zero.
    Added 2004 11.2.1 and 2004 11.2.1M tables.

10/31/11 WJP
  Added Expansion Coefficient and VCF to transaction details.
  Added printing expansion coefficient and VCF to alibi log.
  Added new alibi log label for VCF (U706018).
  Added ticket exp_coeff_pos and vcf_pos (U203) for printing these values on the
printed ticket (defaults to not printing).
  Added sign to the Gravity Display on the alibi log and transaction detail screen.
  Added display of Corrected Gravity to Meter Status Screen, API Diagnostic Screen.
  Correct display of Expansion Coefficient in alibi log.

11/3/11 WJP
  Add format checking to all printf and scanf type application functions.

11/3/11 WJP
```

```
  Added densitygravity_type and corrected_densitygravity_type to the transaction
detail for proper formatting of the densitygravity value.
  Update sprintfexp() to return number of characters written to string.

11/4/11 MSH
  Added Thai translations.

11/7/11 MSH
  Fixed TDS routines to close connection when our local databases are full.  This
should keep the records queued on TDS.

11/9/11 WJP
  Added transaction detail detail screen to view all transaction detail details.

11/10/11 MSH
  Added local database browser for CN builds.  Located under Program
mode\Diagnostics\Local Databases.
  Increased size of local database for vendor BOL storage on CN builds.  Changed
size of database for vendor storage per suggestions from PM.  New values are 1400
vendor BOLs, 20 vendors.  Still 75Klocomotives.

11/15/11 WJP
  In API TABLE_2004_53A, the corrected density is now properly reported.
  The parameter name "API Table Name" was shortened to simply "API Table" to allow
room to display whole 25 character table name.
  Updated all API TABLE_2004_??X tables to report the configured reference
temperature.
  Updated all API TABLE_2004 to limit message logging unless in api table setup
screen.
  On transaction viewer:
    Corrected displayed density index to start at 1.
    Corrected displayed preset, component, meter and additive index to start at 1.
    Only display temp and pressure on preset, component and meter details.
    Updated "Dens" field name to "D/G/RD"
    Corrected previous page opeartions on detail picklist display.
  Changed firmware version to 3/4.31.04.

11/18/11 MSH
  Added new bay level alarm to CN/CONFAR builds, "DB ERROR" which will be set when
the local database is full.

11/16/11 WJP
  Increased min/default/max preset range from 999,999 to 9,999,999.
  Updated default ticket layouts to handle 7 characters for gross and net values.
  Updated alibi log to handle 7 characters for gross and net values.
    Added preset name to alibi log (NMI Req).
  Updated configuration output routines to display 7 characters on UNSIGNED_INT and
ZP_UNSIGNED_INT types.
  Updated transaction detail screen, and transaction detail details screen to
handle 7 characters for gross and net values.
    Corrected alignment issues and ####### overflow indication on additive volume.
    Check against xpos values that could cause lockups on ticket printing of
invalid ticket configurations.

11/28/11 WJP
  Corrected recently introduced bug in computing a VCF from the CTP and CPL for
1980s tables.
```

```
11/29/11 WJP
  Added API Tables 54AG, 54BG, 54CG, and 54DG;

12/17/11 WJP
  When reading a configuration from an SD Card, any rejected commands are added to
the message log.

12/21/11 MSH
  Add Vendor Term ID to Transloading operations.

01/03/12 MSH
  Merge fix from 3/4.31.01 branch
    Fix issue where printing tickets longer than 60 lines cause the firmware to
crash.
      Added range checking to ticket configuration paraemters (R200-R206).
      Increased bspool buffer from 60 lines to 120 lines (2 pages).
      Added safe bspool write routines to prevent writing outside bspool area.
      Added 1 extra line for safety in case any items on the last line wrap to the
next line.

01/04/12 WJP
  Added PTB Alibi Log Capability
    Added PTB Alibi Log Port to Serial Port Selections
      Com port type updated with the followig assignments:
        6 = ALIBI LOG TEXT PORT
        7 = MASS METER PORT
        8 = GPS PORT (not selectable on screen without GPS capability)
        9 = ALIBI LOG PTB PORT
    PTB Alibi Log port also checks handshake lines on COM2.
    Multidrop supported on COM2 RS232 connections.
    Will poll PTB printer every 15 seconds and report a printer error if no
response from PTB printer.

1/12/12 WJP
  Removed degree symbol from AlibiLog output.
  Corrected PTB Alibi Log multidrop functionality.
  Added two pad characters for PTB Alibi Log output.

1/17/12 WJP
  Added ability to inject additive using an analog valve/pump using a PID loop
control.
    Added additive PID loop variables to the bstat struct.
    Added logging of PID values when Additive Trace is enabled in RCU Setup.
    Replaced Piston Injector Used parameter with Additive Type enumeration with the
following assignments:
      ADDITIVE_TYPE_SOLENOID_WITH_METER         0
      ADDITIVE_TYPE_PISTON_WITH_NORM_FEEDBACK   1
      ADDITIVE_TYPE_PISTON_WITH_INV_FEEDBACK    2
      ADDITIVE_TYPE_PISTON_WITH_NO_FEEDBACK     3
      ADDITIVE_TYPE_ANALOG_VALVE_WITH_METER     4
    Removed Pulse Input Used, Piston Input Used, and Feedback Stats Inverted
parameters.
    Added Additive PID P Factor, I Time, and D Time parameters.
    Updated Additive Diagnostics to support new injector type.
    Updated Meter Diagnostics new Analog Output logic.
    Updated Additive FCM Configuration routines to support new additive type.
      Need to retest all additive types, injecting, diagnostics and calibrations.
    Updated analog valve output logic to support additive analog valve.
```

```
      Need to retest meter diagnostic screen with analog valve output.
      Need to add check for misconfiguration of Analog Valves or Additive Analog
Valves attempting to use the same 4-20mA output.

01/19/12 WJP
  Updated the terminal text command, Esc K (Clear EOL) and esc (Clear EOS) to use
the current character attributes unless one is specified using the esc G command.

01/22/12 WJP
  Added new configuration parameter type, API_PRODUCT_TABLE_NAME_TYPE.
    API_PRODUCT_TABLE_NO_PRODUCT   0
    API_PRODUCT_TABLE_PROPAN       1
    API_PRODUCT_TABLE_PROPYLEN     2
    API_PRODUCT_TABLE_BUTAN        3
    API_PRODUCT_TABLE_ISOBUTAN     4
    API_PRODUCT_TABLE_ISOBUTEN     5
    API_PRODUCT_TABLE_CISBUT2EN    6
    API_PRODUCT_TABLE_TRANSBUT2EN  7
    API_PRODUCT_TABLE_BUT1EN       8
    API_PRODUCT_TABLE_BUTA13DIEN   9
    API_PRODUCT_TABLE_METHANOL     10
    API_PRODUCT_TABLE_ETHANOL      11
    API_PRODUCT_TABLE_ISOPROPANOL  12
    API_PRODUCT_TABLE_ISOBUTANOL   13
    API_PRODUCT_TABLE_MTBE         14
    API_PRODUCT_TABLE_TAME         15
    API_PRODUCT_TABLE_BENZOL       16
    API_PRODUCT_TABLE_TOLUOL       17
    API_PRODUCT_TABLE_OXYLOL       18
    API_PRODUCT_TABLE_MXYLOL       19
    API_PRODUCT_TABLE_PXYLOL       20
  Added new component configuration parameter API X Products.
  Added API tables 54XG and 54YG.

01/27/12 WJP
  Changed API_PRODUCT_TABLE_NAME_TYPE to API_54YG_PRODUCT_TYPE.
  Changed api_product_table_name to api_54yg_product.
  Renamed configruation parameter "API X PRODUCTS" to "API 54YG Product".
  Added API tables:
    TABLE_TEC_ETH_US   = 'G',
    TABLE_TEC_ETH_B100 = 200,
    TABLE_TEC_ETH_B40  = 201,
    TABLE_TEC_ETH_E40  = 202,
    TABLE_TEC_ETH_E100 = 203
   Removed tec_eth() function.
   Updated tec() function to accept base temp and expansion coefficient.
   Updated TEC_ETH_xxx calls to use updated tec() function and handle both C and F
temperature units.
   Corrected value placement bug in ticket where gross position was used for the
net value position for placing the measurement character.
   Added api_54yg_product to api setup screen.
  For tables that support both Def F and Deg C (TEC and Ethanol), added logic to
correctly display the correct units and the reference temperature selected.

02/15/12 WJP
  Corrected FCM analog additive simulation.
  Corrected API 54XG table implementation before release.
  Corrected analog additive 4-20mA output scaling and log messages.
```

```
  Updated software copyright year.
  Corrected scaling and update bug in meter and additive analog output diagnostic
screens.

02/21/12 WJP
  Updated the following API table defs for integration with new TMS5 bay code.
    TABLE_54CG    = 'K',
    TABLE_54XG    = 'L',
    TABLE_54YG    = 'O',

02/21/12 WJP
  Increased Message Log from 100 to 750 messages.
  For non-PXA255 builds, added ability to save 90 days of message log files to the
SD Card.
    Each day will be saved into a seperate file in the root directory.
    Attempts to save to the SD Card will be aborted after 5 consective failed
attempts to save to the SD Card.
    On startup or after a reboot, Savnig to teh SD card will resume.
  For UAP or CN builds, added ability to send message log lines to TDS.
  Added internal reference number to all log messages.

02/22/12 WJP
  Updated transaction processing to store any authorized component or additive in
transaction, even if flow volume is zero.
  Corrected recent bug with additive normal piston switch feedback, incorrectly
configuring the FCM version 14 or greater for inverted piston switch input.
  On R910 message log register, max two digit counter to 99 for values over two
digits.

02/24/12 WJP
  Now storing the target additive volume in the net field of the additive
transaction detail record.
  Updated the view transaction archive screen to display the additive target and
delivered volume.
  Updated the view transaction archive screen to display the currently configured
VCF table for each component.

2/28/12 WJP
  Added additive target volume and percent deviation to Alibi Log output.

3/3/12 WJP
  Added log file cleanup and resync when writes to the SD Card are interrupted
(power cycle).
  TODO: Delete oldest log file when freespace is limited.
  TODO: Develop design on time zones on time sync updates from TDS.

3/6/12 MSH
  Added support in web server for download of files from SD card.
  Added logging of user input/selections during prompting sequence.
  CN builds: Added download of CN specific databases, including locomotives,
vendors, vendor BOLs, and drivers.

3/18/12 WJP
  For UAP Builds, increase BOL max lines from 80 to 4 pages (66*4).
  For SIMULATION builds, added \r to diagnostic output for new cygwin terminal.
  Corrected minor compiler warnings.
  For UAP Builds, added LUA script processing for multipage BOL generation.
```

```
4/9/12 MSH
  Added archiving of Lua chunks to flash along with transaction in UAP builds.
  Changed logic of TDS thread to allow processing of lower priority tasks even if
higher priority tasks fail.

4/13/12
  Added Modem init string to General Setup screen.
  UAP development:
    Replaced Modem Init String and Modem Dial String with Terminal ID and Bay ID.
(Modem parameters to be dropped when UAP included in all ML Builds)
    Replaced meter_type field with disabled on the preset table.
    Added supplier number to UAP terminal_profile and preset_authorized_products
tables.
    Added processing of UAP disabled fields in Bay, Meter and Preset tables.
    Added handeling of compartment required fields on Bay and TerminalProfile
tables..
    Added LUA parsing of bay_id and term(inal)_id configuration parameters into LUA.
    Added lookup and error handling for terminal_profile and bay table records.
    Updated UAP product authorizations to use terminal supplier number.
    Updated LUA goto, find and product authorization logging.
    Added logic to exclude saleable products from preset authorized products is the
base components or additives are not present on the additive.
    Added logic to abort LUA processing when a LUA script error occurs.

4/21/12 WJP
  UAP Development:
    Updated simulation build of network_get_mac_address() to get MAC address of
host PC.
    Removed Terminal ID and Bay ID from configuration and from prompt script
startup variables.
    Added LUA mac_address startup variable.
    Changed prompt script to look for the Bay record by using the device IP
adderess.
    Added device address to the "Bay not Found" MessageDenied.
    Added tds_client to Driver find.
    Curreted bug where no pin required, would skip Driver validation.
    Added tds_client and term_id to Carrier picklist and find.
    Renamed PromptVehicle to PromptTruck.
    Added tds_client to Truck find.
    Added tds_client to Trailer find.
    Added ability to find on five fields.
    Correct bug in find routines where search would be aborted if first record was
greater than search record.

4/23/12 MSH
  Beta release to QA
  UAP Development:
    Add support for card reader when in UAP mode.
    Added ability to clear records in individual/all databases.
    Updated transaction payload for communication with TDS.
    BOL reprint logic added to prompting sequence.

4/25/12 MSH
  Fix issue where ML would hang/reboot in multidrop and miswired/not connected.

5/8/12 WJP
  Corrected bug where loss of only the RX line from an FCM will prevent flow
termination and droping of all outputs after 6 seconds.
```

```
    Updated FCM, PCM and Krohne Mass Meter polling logic to wait 8 seconds before
retrying after lost communications.
    This will ensure that any FCM flowing product or with outputs on will stop flow
and drop all outputs.

5/10/12 WJP
  Removed CTS check on PTB Alibi Log Printers.

5/15/12 MSH
  CN builds: Addressed ISS_2045 "Vehicle not archived with transaction" which
affected transload to truck operations

5/16/12 WJP
  Added RCU configuration parameter Trace UAP Level (0=minimal logging, 1=, 2=, 3=,
4=inc low level logic, 5=inc low level com).
  Added low level logging to the UAP product authorization processing.

5/16/12 WJP
  Added Disabled field to UAP TDSClientProducts struct (to be removed again).
  Fixed issue where UAP local database edits did not mark DB as dirty.
  Corrected null error issue with UAP AuthorizeTransaction() when using Prox Cards.
  Bug with UAP Update Saleable Products where Prod ID was checked as Prod Type.
  Added UAP Preset Authorized Products functionalty to include all saleable and
base products when no records are present in the PAP table.

5/17/12 WJP
  Removed Disabled field from UAP TDSClientProducts struct.

5/18/12 WJP
  Updated UAP processing of TDSClientProducts component percent field to contain a
decimal point in 000.0000 format.

6/1/12 WJP
  Updated UAP processing of UAP meter_type field to use P(Product) and A(Additive)
instead of C(Component) and A(Additive).
  Updated UAP processing of UAP prod_type field to use 1(Product) and
2,3,4(Additive) instead of C(Component), A(Additive) and S(Saleable).

06/11/12 WJP
  Added seperate monitoring per port of non_toptech_host connections.

06/29/12 MSH
  UAP - Updated base product process to use comp_add_id rather than meter_id when
assigning products/components to meters.

07/03/12 MSH
  Added two new passwords: 4448 to jump to the view totalizers menu (for
transmontagne), and 4447 to jump to the view transactions screen (for CN).

07/05/12 WJP
  Added prototypes to ml_pm_view.h to remove compiler warnings.
  Corrected var naming of uap_comp_add_id.
  Corrected additive volume in uap transaction record to include three decimal
places.

07/09/12 MSH
  Version number increased to 3/4.31.06 in anticipation of release.
```

```
07/10/12 MSH
  Revert changes to authorization process relating to Meter table.
  Remove comp_add_id from Meter table.

07/24/12 MSH
  Revert changes made to PWM value for display ID 0x02.
  Add new display ID 0x03 for Multiload Mobile display.
  Add setting for max brightness (register 80).

7/27/2012 WJP
  Update MRS gross and net volumes (excluding preset volume whole), to return
volumes in hunds when use_hunds configuration parameter is set.
8/15/2012 WJP
  Added compiler switch in ml_functions.c to Record or Playback keypresses for
demos and automated testing.

8/21/2012 WJP
  Added SD CARD menu to simulation builds.
  Fix possible NULL pointer when saving configuration to the SD card.
  Added compiler switch to supply demo or simple UAP test data when clearing local
database.

8/21/2012 WJP
  Added compiler switch to include UAP Enterprise BOL.

8/21/2012 WJP
  Updated Ticket prompting script to display the ticket prompt number, 1..10.
  Updated Ticket prompting script to verify ticket number is a valid number and
greater than 0.

8/21/2012 WJP
  Updated Ticket prompting script to verify ticket number is not negative.

8/23/2012 WJP
  Replaced Mandarin with Simplified Chinese and added Traditional Chinese.

8/24/2012 WJP
  Appended Bay Number to Preset Number on Alibi Log per Germany requirement.

8/26/2012 WJP
  Updated the functionality on the Message log and W&M Log web pages.
    Corrected bug that prevented the Next/Prev page buttons on the bottom of the
page from working on some web browsers.
    Buttons shifting around made it difficult to quickly page thru.  Updated logic
to keep all buttons visible.
    Added First and Last buttons to quickly move to the first or last page.
    Added 25, 50, 100 buttons to allow displaying more records per page.
    Increased default number of lines shown from 15 to 25.
  Added Transaction Log Summary Page
    Same functionality and feel as the Message Log and W&M Log pages, including the
same buttons and starting on the last page to view the most recent transaction.
    Clicking on a transaction will drive to the detail screen for that transaction.
    Added LUA Data to transaction detail (for UAP) to show all additional record
data also stored with transaction.
    Added Next and Prev buttons to the transaction detail screen to step into other
transaction without returning to the Transaction Log Summary page.

8/31/2012 WJP
```

```
  Added ability to UAP firmware to read the BOL script from the SD Card for
customer/site custom BOL formats.
    On startup, bol_script.LUA is read from the root directory of the SD card.
    bol_scripts directory has been created in Perforce to maintain controlled
version control and history of custom BOLs developed.
    If a bol_script.LUA file is not present, the default_bol_script in the source
code (moved to ml_db.c) will be used.

9/21/2012 MSH
  Added German translation.
  Added Comfort Energy logo.

10/4/2012 MSH
  Fix for display on SMP EXL.  Was broken by 07/24/12 build.

10/11/2012 PS
  Add EOD report for Shell.
    Report triggered by "FEODLOG" command from host.
    Prints totalizers per preset/meter/component to Alibi Log.

10/12/2012 MSH
  Add Meter Creep voucher.

10/16/2012 MSH
  Tweaks to Unauth Flow voucher: formatting, net volume.
  Change to how we handle meter creep/unauthorized flow.
    We will no longer generate a ticket for the meter creep.
    We will print a Unauth Flow (meter creep) voucher for all unauthorized flow
regardless of whether drive is carded in or not.

10/25/2012 MSH
  Added new web server based on Mongoose open source web server.
    Ported existing ML pages over to new web server.
    Added authentication for web pages.  Both an "admin" (read-write) and "user"
(read-only) user.
    Added file upload to SD card.

11/01/2012 PS
  Fix the MAX_API_TABLES count
  Comment out the 1122 Pressure tables

11/01/2012 PS
  Added ability that Multimate and other systems can download the picklist
possibilities via the r300 prompt register

11/01/2012 PS
  Increase 4 times the alibilog

11/01/2012 PS
  Fix alignment issue on Gross Totalizers EOD-Report (FEODLOG-command)

11/01/2012 PS
  German prompt fix


11/01/2012 PS
  Changed revision to 3/4.31.07
  and for nvram alibilog
```

11/02/2012 PS

Add ability of EOD-Report to trigger via modbus

11/04/2012 WJP

Added RCU general configuratuion parameter (R/U076) Ethernet HTTP "admin" Password (default "toptech")

Added RCU general configuratuion parameter (R/U077) Ethernet HTTP "user" Password (default "toptech")

11/06/2012 PS

Integrated a Low Flow Proving Rate, so during proving another low flow rate can be giving instead of using

the preset low flow rate

11/6/2012

Corrected bug in UAP script with respect to picklist paging. PickListHandle() calls in the prompt script must NOT have commands following it on the same line.

11/7/2012 WJP

Corrected UAP bug where a blank driver PIN was still prompted for when pin_req was not "N".

Updated UAP LUA script error processing to display message as well as writing it into the message log.

Correct web file upload naming to correctly deal with windows "\"s in filenames.

11/7/2012 PSFix transaction viewer via web-interface. Values were not reflected correctly. Density, Relative, Pressure, possible hundredths mode, Alarm, Measurement approved

11/9/2012 PS

Remove Time of UAP R000 register

11/13/2012 WJP

Corrected UAP bug that caused TDS transactions and BOLs to omit data fields when special characters, for example ""(quotes), appeared in the UAP database values.

11/19/2012 PS

fix bug in reading via modbus relative density

add new functionality of BSW real-time analog input , all parameters, transactionviewer also store value, alibilog , ticketbuilder, reading live BSW via MRS, modbus functional, bsw can be back-calculated blending

add new functionality of API Gravity real-time analog input, all parameters, reading live API Gravity via MRS, modbus functional, api gravity can be back-calculated blending

add new functionality to simulate analog input each fcm number will bump the current with 300mA

changed meter screens logic that only 1 density type is shown at a time: api gravity or relative density or density

changed sd_card routine that we store all parameters even if higher than 100 registers

changed boot config check that we check more than 100 registers for each level

```
  added BSW into UAP build

11/19/2012 PS
  added change that prompts higher than 100 can be read. r-command

11/20/2012 PS
  API Table function has now a Test API Gravity instead of using the real API
Gravity. No W&M key needs to be turned on
  Added on the MRS command for BSW and API Gravity the average of meter and
component level
  Merge display denstiy_type routine to one routine.

11/21/2012 PS
  Fix issue on ticket printer that only on the total amount the hundreths digit was
missing for gross and net

11/26/2012 PS
  Added ability to store alarms by batch into transaction for preset, meter,
component and additive level
  Added ability to view batch alarms in transaction viewer and webpage
transactionviewer
  Added ability to print the alarms by batch on the alibilog printer
  Fixed bug that webtransaction viewer would never show type 4 meter level

11/26/2012 PS
  Fix language german for product screen and layout

11/28/2012 PS
  Fix language german for Network screen alignment for counts was wrong

11/28/2012 PS
  UAP fix ticket number tracelog messages , always a diff of 1
  UAP fix during tds send of transaction, could clear transaction LUA data

11/28/2012 PS
  UAP fix that stack doesn't overflow when checking transactions view web interface

11/29/2012 PS
  Enhance German language on Main Meter Screens

12/03/2012 PS
  Fix Color selection on the Multiload screen was not working 100%

12/04/2012 PS
  Delete ENTERPRISE BOL out of tds routine and made a seperate bol script

12/04/2012 PS
  Enhance Meter trace for analog valves (only for FCM2 not IO-boards),also limit
between 0 and 24mA

13/04/2012 PS
  Enhance the SD-Card menu
  Each Menu will only show the files with the correct extension to prevent
selecting invalid files
  Web-interface will still show all files on the sd-card

12/7/2012 WJP
  Include UAP functionality into standard MultiLoad firmware builds.
```

```
  Remove ability to build special UAP MultiLoad builds.
  Remove ability to build ml_uap_sim from the Makefile.
  Remove UAP special build label.
  Correct #ifdef TDS_INTERFACE/#endif alignments in source.
  Correct size of returned LUA Data in web transaction viewer.
  On ml_tds_3op and ml_db, added ability to selectivly start or stop tasks.
  Updated database viewer to return if ml_db has not started.
  Corrected UAP BOL duplicate label to use transaction_printed_bit_table.
  Only include Local Databases item on Program Mode Menu when Processing Mode is
set to UAP.
  Delay processing first TDS_3PO call (1 minute) until after the ml_db has started
(5 seconds)

12/09/2012 PS
  Change default Meter Archive timeout and host down timeout from 30 to 120 seconds

13/12/2012 PS
  UAP Fix when driver and card number are not equal then reprint doesn't work,
because database has driver number, reprint search on card number
  UAP Fix alignment issue on Reprint Prompt


12/17/2012 PS
  New enhancement Low Flow Start Volume Based on Percentage

12/17/2012 PS
  Enhancement on UAP ticket number Webpage, TransactionViewer and BOLs

12/17/2012 PS
  Enhancement on UAP ticket date change be change to MM/DD/YY or DD/MM/YY

12/19/2012 WJP - Release to Customer
  Correct Print_Blend_Details so when:
    0 - Exclude components, additives and meters.
    1 - Include components, additives and meters(only when meters are needed).
    2 - Include components, additives and meters(always include meters, even when
not needed).
  Updated Low Flow Start Volume to use the greater or either the configured Low
Flow Start Volume or the computed Low Flow Start Volume by Percentage.
  Low Flow Restart Volume always uses the configured Low Flow Restart Volume.

12/24/2012 PS
  Enhance Network Menu combining parameters under a new webpage menu
  Add new Network Printer Menu

12/25/2012 PS
  Enhance modbus interface that all transaction values are readable
    api_expansion_coef_tenths
    corrected_densitygravity
    volume_correction_factor
    bsw_hund
    alibilog_alarm

12/26/2012 PS
  Restrict low flow start volume to 65535 when using low flow percentage
12/29/2012 PS
  New feature deadman with input and output signal, deadman interval timer, deadman
warning timer.
```

```
  3 modes: Continuous push, Continuous push with scheduled periodic release,
Scheduled periodic releases.
  All signals are added to the Bay Diagnostic screen.
  New alarm added *DEADMAN.

01/01/2013 PS
  New feature FKEYPADON and FKEYPADOFF, this gives the capability to disable the
keypad.
  Stop button will still work to ensure driver can always stop the load
  Also the Idle and the Menu screen are not keypad locked
  Modbus commands added Reg 7008 and 7009
  Copyright changed to 2013

01/02/2013 PS
  Enhancement Default startup mode if keypad is locked or unlocked

01/02/2013 WJP
  Added the ability for bol printing on ethernet printers.

01/03/2012 PS
  Add Bsw to Webinterface Transaction View

01/04/2013 PS
  Changed UNAUTH FLOW voucher that we take alibilog labels for GROSS and NET, also
remove approval chars

01/11/2013 PS
  Added new bio ethanol API tables PTB Method 3 , for Products E5, E10, E80, E85,
E100, Benzin/Petrol, Diesel, B5 RME, B7 RME, B100RME, B5 SME ,
  B7 SME, B100SME.
  Corrected Density 15degrees has a fixed value for BIO components
  Added picklist routines and read register for Multimate

01/12/2013 PS
  Enhancement UNAUTH FLOW Voucher will use the real-time unauth totalizer amount
instead of the clear amount on the component level.
  This is to ensure the full amount is always on the alibilog.

01/15/2013 PS
  Added rollover check to unauthorized flow voucher
  New feature non-proportional ratio and side-stream blending, the component max
flow rate will be used to determin the high flow
  The main component (highest percentage) which flow in low flow all other
component wait until the high flow start is reached.
  Blend check is only done at the end of the load load, during the load the product
is never in spec only at the end.
  Fallback and flush feature are still working in the non-proportional
enhancements.

01/16/2013 PS
  Added Time on Main Loading Screen for all devices except SMP


01/29/2013 PS
  Added Alcohol Table Brazil NBR 5992

01/30/2013 PS
  Fix double use of RCU Registers 79 and 80
```

```
  Change firmware number to x.31.09
  SD-card will save register 78, 79 and 80
  Changed equipment database version to 3.31.09.

01/31/2013 PS
  Added Hydrocarbon Table Brazil (LPG, Gasoline, Diesel, Lubes, Crude, Asfalt and
heavy oils)

01/31/2013 PS
  Enhance sd card filelists to only display select extensions (.bmp, .mlc, .bin)
ignoring extension case.


Release 3/4.31.09

02/04/2013 PS
  Enhancement of Deadman with bypass key, to disable deadman function without going
into program mode

02/11/2013 PS
  Added API alarm timeout so, alarm would not raise after x time. Vcf stays the
last known value
  Changed version number to x.31.10

02/15/2013 PS
  Enhance UAP that Product Message is after each the product/component line
  Swapped UAP Bol City line with Phone number line
  Fix UAP Bol when more than 1 page, cursor would not follow the end of copy line

02/21/2013 WJP
  Trim CRs and LFs from BOL script to prevent TDS communications from hanging on
message_log lines with CRs.

02/22/2013 PS
  Enhancement of the Alarm Screens
  Added new functionality that each status alarm
(bay,preset,meter,component,additive) can be hidden for any remote system.


2/26/2013 WJP
  Added Driver Routines to read NVRAM Battery Monitor Voltage and Temperature.
  Added Battery Monitor Service Routine to Check Battery Voltage every 24 hours.

2/26/2013 PS
  Added new alarm routine which give all 32 bit alarm states.
  New communication commands are added Bay(MRBA32),Preset(MRPA32, MRPA),
Meter(MRMA32), Comp(MRCA32), Add(MRAA32).

03/01/2013 PS
  Enhancement of new Menu Level under Equipment Setup for settings up the
Multiload2

03/02/2013 PS
  Add Deadman functionality also to Custom Logic

03/06/2013 PS
  Enhancement on payload transaction to UAP. Added BSW and Pressure to the
transaction file.
```

03/07/2013 PS
Enhancement of Custom Logic supports now Temperature, BSW, Gravity, Relative Density, Density, Pressure, Volumes
Enhancement of Custom Logic supports now Timers Start and Stop Delay.

03/07/2013 WJP
Added display of Battery Voltage and Temperature on RCU Diagnostics screen (only if CPU board supports the feature).

03/08/2013 PS
Enhancement of Register800 to always transaction read of
api_expansion_coef_tenths, corrected_densitygravity, volume_correction_factor, bsw_hund, alibilog_alarm

03/08/2013 PS
Added Bay Number to the Web-Interface

03/11/2013 PS
Fix Ticket Print: Measure used was on totalizer line correct for gross , but incorrect for net.
Also allow totalizer to be shown with max value of 999999999
Fix Measure used for Additive Totalizer Line was missing

03/12/2013 PS
Added in Custom Logic the State for Preset,Meter,Component (High Flow, Low Flow, ...)
Added in Custom Logic under Rcu Real Time Parameters the Date and Time value

03/12/2013 WJP
Corrected bug on SMP firmware builds where the editing of parameters on the RCU General screen edited the wrong parameter.

03/12/2013 WJP
Update TDS 3po checksum routine to stop converting all incomming and outgoing data to upper case.

03/18/2013 WJP
Corrected bug (may have been created on 5/17/2011) in processing and prompting for PIN numbers when processing mode is set to Stand-Alone.

03/19/2013 WJP
Added ability to support two different serial ports set to host mode.

03/21/2013 WJP
Added MRTDpppddd command to directly read the transaction details, for a specified preset, archived after clearing each batch.

03/29/2013 WJP
Added Batch Number (1-9,999,999) to the transaction archive details.

Added printing BSW on UAP tickets (previously missing).

Added printing Batch Number on UAP tickets.

Added printing Batch Numer on Stand Alone tickets.

Added new LUA command, SetDetailBatchNumberPos(), to BOL script processing.

Added SetDetailBswPos() and SetDetailBatchNumberPos() to default BOL script.

Added Batch Number to transaction details in the MRTDppp and R800 commands.

Added Batch Number to the Transaction Viewer Screen.

Added Stand Alone Batch Number ticket position to R203.

Added R006 command to read the current (last assigned) Batch Number.

Added Batch Number to the Web Server Transaction Detail Viewer.

03/29/2013 PS

Adding new alibilog label BATCH and adding batch number to the alibilog transaction

04/02/2013 PS

Transaction to UAP had always spaces in po_number changed to get it from account record

04/04/2013 PS

Change batch number from bay level to preset level.

Added batch number to unauth flow voucher, which will have also a different batch number. (Transaction will be not stored)

04/05/2013 PS

Add batch_number to the modbus protocol so it can be read out of the transaction

04/05/2013 PS

Add new features to Custom Logic

Beacon: Pulse generator, variable ON and OFF time

Pulse: Single Puls on a high input trigger and variable ON time

04/10/2013

Found many issues with language selection in MultiLoad. This impacted displaying the correct language and footers with some stand alone, UAP and host configurations.

Incorrectly referencing the driver_language for the stand alone driver card database instead of program_mode_language.

Picklist footers in 5 program mode UAP database screens

Picklist footers in 5 diagnostic screens.

Incorrectly referencing the default_alt_langauge instead of the currently selected driver langauge.

Host commanded picklist footers.

Incorrectly referencing the driver_language configuration parameter instead of the currently selected driver language.

Messages for Authorizing Transaction, Completing Transaction, Transaction Done, Transaction Cancelled, Authorized to Load, Please Wait, and Keypad Locked.

TDS connection staus messages, GPS messages, Reprint Ticket, CN Prompts, and all Meter Screens.

Language on the Idle Screen Logo images.

UAP authorization picklists.

Incorrectly only referencing the driver language for the stand alone driver card database instead of the currently selected driver_language.

Uploaded host messages for Please Wait, Insert Card, Remove Card, Invalid Card, Press Any Key for Access, and System Unavailable.

Custom Stand Alone Prompts.

On display of the card in screen, current driver language was being set to the default_alt_language instead of the driver_language configuration parameter.

Updated native and modbus protocols to update the currently selected driver language when the driver_language configuration parameter is updated.

Since language does not exist in the UAP driver database, update the currently selected driver language to the driver_language configuration parameter for UAP driver authorization.

Removed the default_alt_language configuration parameter.

Host bay code needs to be updated to:

1. Once a driver card is read and the driver language is known, update the R008 register (driver language) with the driver language using the following index mapping table. (ie. tms language 45 is german, converts to index 4 in ML)

```
#define LANGUAGE_ENGLISH    0
#define LANGUAGE_SPANISH    1
#define LANGUAGE_PORTUGUESE 2
#define LANGUAGE_FRENCH     3
#define LANGUAGE_GERMAN     4
#define LANGUAGE_SIMPLIFIED_CHINESE 5
#define LANGUAGE_TRADITIONAL_CHINESE 6
#define LANGUAGE_THAI       7
```

2. Keep the current operation of reading the TMS language prompt database at language index 0 and writing this prompt into R700xx0 registers for older MultiLoad firmware.

3. Read the TMS language prompt database for the selected driver language (ie. tms language 45 is german) and write this prompt into R700xxl where l is the same index that was written into R008 (ie. 4 for german).

4. Update the R008 register (driver language) with the default driver language once the driver transaction is done or cancelled.

04/07/2013 PS

Fixed update Custom Logic via ml_terminal or ml_modbus

Added to fcm_control logic for mass level

Added Mass to the transaction archive details.

Added printing mass on UAP tickets.

Added printing mass on Stand Alone tickets.

Added new LUA command, SetDetailMassNumberPos(), to BOL script processing.

Added SetDetailMassPos() to default BOL script.

Added Mass to transaction details in the MRTDppp and R800 commands.

Added Mass to the Transaction Viewer Screen.

Added MRS command to read the current mass.

Added Mass to the Web Server Transaction Detail Viewer.

Added Mass to Alibilog only saleable product(will not print when Mass is ZERO)

Added new mass totalizer to Totalizer Screen

Added new register R114 to read real-time Mass Totalizers

Added real-time preset gross/net/mass totalizers to CONTROL SCREEN

Added new mass_measured_used_type on RCU Level

Added new mass_measured_used_type to r133 Register

Added new alibilog labels for mass

Added new ml_weight.c

Added Mass on Preset Screen

Added Mass on Component Screen

Enhanced Deliver in Net Parameter to Deliver_type (Gross or Net or Mass)

Added new deliver_type to r133 Register

Added new message on Preset Screen (Volume_unit) corrected to (Mass_Unit)

Added all previous change for Mass also in hundreths mode

Added routine to go from weight_to_net and net_to_gross

Added routine to go from measured_unit to mass_measured_unit (mass units in the measured_unit are out of scope)

Updated all Meter_Type for volume and mass totalizer calculations

Added Date to the Preset Control Screen (Mode DD/MM/YYYY or MM/DD/YYYY)

Fixed bug for alibilog when in hundreths mode that the decimal points would be not converted to comma only saleable level

Moved Time on Preset COntrol Screen next to the date value

Enhancement on EOD-Report include now also Mass Totalizers and Thruput

Fixed bug in EOD-Report if more than 1 meter per arm was assigned , report would loop multiple times

Added new thruput totalizers (auth + unauth volume) for Gross, Net, Mass

Added Mass calculations when using online density/relative/API Gravity instead of using

- Mass = (Net * Dens) we will use Mass = (Gross * Dens)

Added DINISO rounding routines for weight

When not loading in hundreths net and mass gets calculate from whole values

Added new Mass Calculator Screen (starts from Net volume to Mass)

Added Mass to Custom Logic Preset and Component Level

Added missing net hundreths level to clear reset (component level)

4/17/2013 WJP

Fixed bug in UAP bol processing where sometimes the header lines would not get copied to other pages.

Corrected bug in UAP BOL default script where one detail line on the start of new pages was lost.

Updated UAP BOL default script to add a dividing line under the column headers and after all column data to help readability.

Updated UAP BOL default script to keep all footer lines on the same page.

4/18/2013 WJP

Global rename of “thruput” totalizer to "alibilog_daily_gross_del".

With mass delivery as an option, clarify some global fields across source files:

Global rename batch_volume_del to batch_del.

Global rename volume_preset_whole to preset_whole.

Global rename load_volume_del to load_del.

Global rename batch_volume_ to batch_.

4/22/2013 WJP

Increased resolution of transaction temperature from tenths to hundredths.

Updated view transactions and web transaction viewer to display temperature in hundredths.

Added temperature in hundredths to the end of the R800 and MRTD commands as %05d (implied 2 decimal digits).

Kept existing transaction temperature reads in tenths for backward compatibility.

Kept existing TDS transaction detail temperature field in tenths for backward compatibility.

04/24/2013 PS

Store Mass Totalizers for each loaded Batch

Added to Transaction Viewer the Mass Totalizer

Added to Webinterface the Mass Totalizer

Fixed Hundrehts totalizers in Webinterface would show whole totalizers

Added Mass Totalizers to Alibi Log

Added to Unauthorized flow voucher the mass value

Added to Ticket Printer in Standalone the mass totalizers (not for UAP)

04/25/2013 PS

Added check when delivery type is mass that the mass measure used cannot be NONE

Added check when delivery type is net or mass that the measure used cannot be NONE

04/27/2013 WJP

Updated U700 so language index 0 is used before any other language indexes (1..MAX_LANG) to maintain backwards compatability.

Added new card_reader_types to support non-captive card readers and ibutton readers.

Added new U700 strings to support "Swipe Card" and "Touch iButton" messages.

04/28/2013 PS

Added iButton routine to read the iButton Reader, also updated the keypad firmware v003.

Added new diagnostic screen to see ibutton reader data, with read counter.

Added iButton animation on the IDLE Screen

04/28/2013 WJP

Added support and card reader types for noncaptive card readers (India Req.).

Changed Driver Card Number from an Integer to a String for iButton Support.

Manual entry of Card Numbers (Access ID setup and Card Reader Disabled) zero pads numbers.

UAP, TMS and MultiMate uploads of Driver Card Number data should be zero padded before uploading.

UAP, TMS and MultiMate should be updated to support alphanumerics (hex) data for ibutton support.

TMS needs to be updated to support the following card reader types for MultiLoad/SMP:

```
#define CARD_READER_TYPE_DISABLED           0
#define CARD_READER_TYPE_BUCKET_CAPTIVE     1
#define CARD_READER_TYPE_BUCKET_NONCAPTIVE  2
#define CARD_READER_TYPE_SLOT_CAPTIVE       3
#define CARD_READER_TYPE_SLOT_NONCAPTIVE    4
#define CARD_READER_TYPE_IBUTTON            5
```

04/29/2013 PS

Increased firmware number to x.31.11 for Mass changes

05/01/2013 PS

Added Raizen Logo

05/03/2013 PS

Added new feature that prompts1 to 4 can be used in custom logic (remark entry value will stay, until next driver enter new value)

Added new feature that Alibilog can print all 5 prompts when they are not blank, prompts can contain any data.

Also added 5 new alibilog labels for the 5 prompts, default names are Stockholder,Customer,Account,Destination,Driver.

05/04/2013 PS

Added new fifth standalone Prompt, updated all protocols, can be also used on standalone BOL.

Enhancement all prompts are getting clear at the end of the load, only in standalone mode.

Added new feature that output pulse on Preset Level can also be Mass

05/06/2013 WJP

Update UAP Set_Max_Preset() routine to ignore limit when Max Load Qty from TDS is 0 or blank.

05/9/2013 WJP

Added debug code to assist with incorporating new TFT displays.

Added TEST_NEW_DISPLAY precompiler flag to force display of the display diagnostic screen on powerup.

Added a screen to adjust and apply changes to the display parameters when the TEST_NEW_DISPLAY precompiler flag is defined.

05/11/2013 PS

Enhancement of Custom Logic added analog in , analog out and RTD input for only FCM2.

Added also to modbus as other protocols.

Added to Diagnostic Mode.

Added check if analog output is already used by meter level for valve control.

05/14/2013 PS

Added Canexus Logo

Added Alarm Ouput for each alarm on global alarm level

05/15/2013 PS

Enhancement on Custom Logic:

Each Alarm Level Bay, Preset, Meter, Component and Additive can be used for a certain/specific Bay, Preset, Meter, Component and Additive.

Also added this to all communication protocols as modbus.

05/16/2013 PS

Added 2 new API tables for Alcohol, these tables use temperature and density as an input and will give the alcohol percentage of the product.

05/17/2013 PS

Change German Ethanol table from temperature hundreths to tenths mode.

Added totalizers to UAP Bol.

05/18/2013 PS

Added new feature to mask the storage of an alarm. Results in tot storing, printing the alarm.

Update communication protocols.

05/18/2013 PS

Added density air for less then 996.6 (1.1 kg/m3), range 996.6 to 1663.5 (1.0 kg/m3) and greater then 1663.5 (0.9 kg/m3)

05/30/2013 WJP

Added simulation control web page to allow:

Change meter simulation between Auto, Force Flow and Hold Flow.

Change additive simulation between Auto, Force Flow and Hold Flow.

Change input port simulation between Auto, Force On and Hold Off.

05/30/2013 WJP

Added CTL and CPL display on the component status screen and api table setup screen.

Update CN code to work with previous card_id parameter change.

06/15/2013 WJP

Corrected Weighted Average Routine for Temp, Density, Rel. Density, Pressure, Gravity, BSW where negative values were always computed as one least significant unit lower than actual at the component level (-0.01 temp for example) and two least significant units lower than actual at the preset level (-0.02 temp for example).

```
06/23/2013 WJP
  Remove not batch_complete check from remote_clear input processing.
  Added DEBUG_VOLUME and MEMORY_FILL test code.
```